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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer.*

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Includes exobiology; planetary biology; and extraterrestrial life.

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Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

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75 PLASMA PHYSICS 2660
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For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS 2661
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 2664
Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2664
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2665
Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY 2666
Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2666
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2670
Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 ASTROPHYSICS 2671
Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

91 LUNAR AND PLANETARY EXPLORATION N.A.
Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

92 SOLAR PHYSICS 2683
Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

93 SPACE RADIATION 2684
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

99 GENERAL 2684

Note: N.A. means that no abstracts were assigned to this category for this issue.

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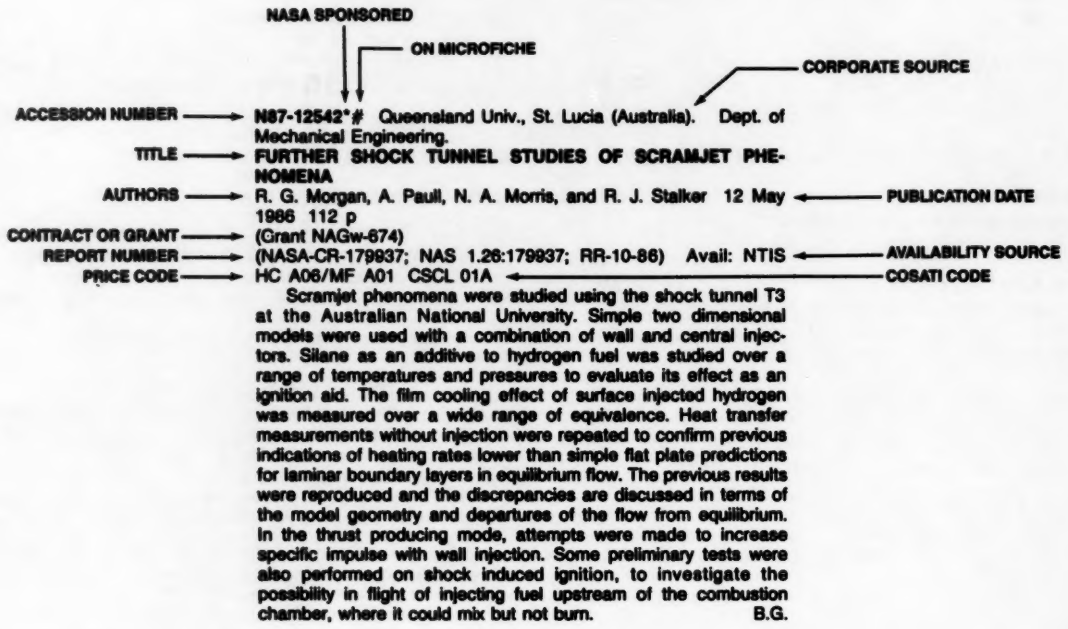
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CORPORATE SOURCE
ACCESSION NUMBER
N87-12542*# Queensland Univ., St. Lucia (Australia). Dept. of Mechanical Engineering.
TITLE
FURTHER SHOCK TUNNEL STUDIES OF SCRAMJET PHENOMENA
AUTHORS
R. G. Morgan, A. Paull, N. A. Morris, and R. J. Stalker 12 May 1986 112 p
PUBLICATION DATE
CONTRACT OR GRANT
(Grant NAGw-674)
REPORT NUMBER
(NASA-CR-179937; NAS 1.26:179937; RR-10-86) Avail: NTIS
AVAILABILITY SOURCE
PRICE CODE
HC A06/MF A01 CSCL 01A
COSATI CODE
Scramjet phenomena were studied using the shock tunnel T3 at the Australian National University. Simple two dimensional models were used with a combination of wall and central injectors. Silane as an additive to hydrogen fuel was studied over a range of temperatures and pressures to evaluate its effect as an ignition aid. The film cooling effect of surface injected hydrogen was measured over a wide range of equivalence. Heat transfer measurements without injection were repeated to confirm previous indications of heating rates lower than simple flat plate predictions for laminar boundary layers in equilibrium flow. The previous results were reproduced and the discrepancies are discussed in terms of the model geometry and departures of the flow from equilibrium. In the thrust producing mode, attempts were made to increase specific impulse with wall injection. Some preliminary tests were also performed on shock induced ignition, to investigate the possibility in flight of injecting fuel upstream of the combustion chamber, where it could mix but not burn. B.G.

VOLUME 25 NUMBER 19 / OCTOBER 8, 1987

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N87-25267*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND SHEAR/TURBULENCE INPUTS TO FLIGHT SIMULATION AND SYSTEMS CERTIFICATION
Roland L. Bowles, ed. and Walter Frost, ed. (FWG Associates, Inc., Tullahoma, Tenn.) Jul. 1987 272 p Workshop held in Hampton, Va., 30 May - 1 Jun. 1984
(NASA-CP-2474; L-16329; NAS 1.55:2474) Avail: NTIS HC A12/MF A01 CSCL 01B

The purpose of the workshop was to provide a forum for industry, universities, and government to assess current status and likely future requirements for application of flight simulators to aviation safety concerns and system certification issues associated with wind shear and atmospheric turbulence. Research findings presented included characterization of wind shear and turbulence hazards based on modeling efforts and quantitative results obtained from field measurement programs. Future research thrusts needed to maximally exploit flight simulators for aviation safety application involving wind shear and turbulence were identified. The conference contained sessions on: Existing wind shear data and simulator implementation initiatives; Invited papers regarding wind shear and turbulence simulation requirements; and Committee working session reports. For individual titles, see N87-25268 through N87-25288.

N87-25268*# Federal Aviation Administration, Washington, D.C.
CASE HISTORY OF FAA/SRI WIND SHEAR MODELS **c47**
Herbert Schlickenmaier *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 3-10 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

In order to understand the development of the FAA/SRI wind fields, it is important to understand the operating philosophy of the FAA's Wind Shear Program Office. The goal of the office was to ensure an integrated solution to the wind shear problem which addressed three area: ground based equipment and coordination; airborne systems and procedures; and weather prediction. This triply addressed goal was central to the development of the wind fields. The primary user of the wind shear modeling during the FAA's program was airborne simulation. The project requirement was to use wind shear models that resulted from accidents so that effective procedures and/or equipment could be found for hazardous wind shear encounters. The wind shear model development is discussed in detail. Author

N87-25269*# Federal Aviation Administration, Washington, D.C. Office of Flight Operations.
HISTORY OF WIND SHEAR TURBULENCE MODELS **c47**
Lou Cusimano *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 11-12 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

The Office of Flight Operations, Flight Technical Programs Div., at the FAA Headquarters, interfaces with industry, R&D communities and air carriers during the introduction of new types of equipment into operational services. A brief highlight of the need which FAA operations sees for new wind shear and turbulence data sets from the viewpoint of equipment certification and simulation is presented. Author

N87-25270*# National Center for Atmospheric Research, Boulder, Colo. JAWS Project.
INTRODUCTION TO THE JAWS PROGRAM **c47**
John McCarthy *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 13-27 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

The JAWS Project is the Joint Airport Weather Studies project conceived in 1980 jointly between the National Center for Atmospheric Research and the Univ. of Chicago. The objectives of the program are threefold: (1) Basic scientific characterization of the microbursts and the statistics of microbursts occurrence; (2) Detection and warning, using the Low Level Wind Shear Alert System (LLWSAS) operation and performance; and (3) Doppler radar and airborne systems. These goals and the operation of the JAWS system in general are discussed in detail. Author

N87-25271*# National Center for Atmospheric Research, Boulder, Colo. Joint Airport Weather Studies Project.
JAWS MULTIPLE DOPPLER DERIVED WINDS **c47**
Kimberly L. Elmore *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 29-42 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

An elementary working knowledge is given of the advantages and limitations of the multiple Doppler radar analyses that have recently become available from the Joint Airport Weather Studies (JAWS) project. What Doppler radar is and what it does is addressed and the way Doppler radars were used in the JAWS project to gather wind shear data is described. The working definition of wind shear used is winds that affect aircraft flight over a span of 15 to 45 seconds and turbulence is defined as air motion that cause abrupt aircraft motions. The JAWS data current available contain no turbulence data. The concept of multiple Doppler analysis and the geometry of how it works are described, followed by an explanation of how data gathered in radar space are interpolated to a common Cartesian coordinate system and the limitations involved. A discussion is also presented of the analysis grid and how it was constructed. What the user actually gets is discussed, followed by a discussion of the expected errors in the three orthogonal wind components. Finally, a discussion is presented of why JAWS data are significant. Author

N87-25272*# National Center for Atmospheric Research, Boulder, Colo. JAWS Project.
STATUS OF THE JAWS PROGRAM **c47**
John McCarthy *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 43-47 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

Preliminary data description of the August 5, 1982, microburst case is available. Its use in simulation of microburst is discussed, excluding the turbulence part, since it is not available. Author

N87-25273*# FWG Associates, Inc., Tullahoma, Tenn.
MODELING AND IMPLEMENTATION OF WIND SHEAR DATA **c82**
Walter Frost *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 49-66 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 05B

The problems of implementing the JAWS wind shear data are discussed. The data sets are described from the view of utilizing them in an aircraft performance computer program. Then, some of the problems of nonstandard procedures are described in terms of programming the equations of aircraft motion when the effects of temporal and spatially variable winds are included. Finally, some of the computed effects of the various wind shear terms are shown. Author

N87-25274*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND SHEAR AND TURBULENCE SIMULATION **c47**
Roland L. Bowles *In its* Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 67-95 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

The aviation community is increasing its reliance on flight simulators. This is true both in pilot training and in research and development. In moving research concepts through the development pipeline, there is a sequence of events which take place: analysis, ground based simulation, inflight simulation, and flight testing. Increasing fidelity as progress toward the flight testing arena is accompanied by increasing cost. The question that seems to be posed in relation to the meteorological aspects of flight simulation is, How much fidelity is enough and can it be quantified. As a part of the Langley Simulation Technology Program, there are three principal areas of focus, one being improved simulation of weather hazards. A close liaison with the JAWS project was established because of the Langley Simulation Technology interests regarding reliable simulation of severe convective weather phenomena and their impact on aviation systems. Simulation offers the only feasible approach for examining the utility of new technology and new procedures for coping with severe convective weather phenomena such as wind shear. These simulation concepts are discussed in detail. Author

N87-25275*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATION OF DATA TO PILOTED SIMULATORS **c09**
Richard S. Bray *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 97-115 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 14B

The application of a further developed analytical model and JAWS data to a piloted simulator is addressed. The Ames simulator provides a facility for the development of piloting procedures, and for the selection of training scenarios. The system is operational with the new wind shear models and comprehensive data output. The use of these models with the simulator is dicussed in detail. Author

N87-25276*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
B-57B GUST GRADIENT PROGRAM **c05**
Dennis W. Camp *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 117-124 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

The NASA B-57B Gust Gradient Program (GGP) is a NASA multicenter program. The program objectives are presented. The primary objective is to get wind gust data which can be used in new design criteria for aeronautical systems. The GGP data could also be used to provide turbulence information for use in simulation programs. This program is outlined. Author

N87-25277*# FWG Associates, Inc., Tullahoma, Tenn.
TURBULENCE MODELS **c47**
Walter Frost *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 125-151 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

The subject of modeling turbulence for use with the JAWS wind shear data sets is addressed. The present FAA AC 120-41 wind shear models are quasisteady wind models. FAA recommends superimposing upon these winds a Dryden spectrum model of turbulence. For the JAWS data, it must be decided whether this approach is adequate or whether turbulence must be analyzed and modeled differently. This question is discussed in detail. Author

N87-25278*# Boeing Commercial Airplane Co., Seattle, Wash.
MICROBURST MODEL REQUIREMENTS FOR FLIGHT SIMULATION: AN AIRFRAME MANUFACTURER'S PERSPECTIVE **c09**
Richard L. Schoenman *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 153-164 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 14B

A brief outline is given of topics for presentation and discussion at the workshop. As manufacturers and certifiers of transport airplanes and associated on-board systems, an interest in the prevention of wind shear related accidents and incidents is inherent. The near term objectives are to provide the customers technical support in the areas of training as well as to research existing and potentially improved on-board systems. In the future, many improved systems should be implemented. This will require certification as well as further educational activity in the use of these new systems. A set of wind models is needed for design work which characterize a wide variety of real microbursts as measured during the JAWS project. The wind models should be limited in both size and complexity to just those features which degrade aircraft performance. Author

N87-25279*# Sperry Flight Systems, Glendale, Ariz. Avionics Div.
AUTOMATIC SYSTEMS AND THE LOW-LEVEL WIND HAZARD **c08**
Dwight R. Schaeffer *In* NASA. Langley Research Center, Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 165-172 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

Automatic flight control systems provide means for significantly enhancing survivability in severe wind hazards. The technology required to produce the necessary control algorithms is available and has been made technically feasible by the advent of digital flight control systems and accurate, low-noise sensors, especially strap-down inertial sensors. The application of this technology and these means has not generally been enabled except for automatic landing systems, and even then the potential has not been fully exploited. To fully exploit the potential of automatic systems for enhancing safety in wind hazards requires providing incentives, creating demand, inspiring competition, education, and eliminating prejudicial disincentitives to overcome the economic penalties associated with the extensive and riskly development and certification of these systems. If these changes will come about at all, it will likely be through changes in the regulations provided by the certifying agencies. Author

N87-25280*# CAE Industries, Ltd., Montreal (Quebec).
SIMULATOR MANUFACTURERS' REQUIREMENTS **c09**
David R. Reilly *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 173-180 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 14B

Simulator manufacturers must continue to provide the customers the latest wind shear models available for pilot training. The release of the JAWS data package enabled the provision of a much more realistic wind shear package to the customer rather than just the standard six SRI wind shear profiles currently in use. In this brief presentation, the steps taken in implementing the JAWS data into the FAA 727 simulator are highlighted. Author

N87-25281*# Calspan Corp., Buffalo, N. Y.
MILITARY SPECIFICATIONS **c05**
Philip Reynolds *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 181-195 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

The current situation relative to the military specification is that there is not one specific model of turbulence which people are using. Particular disagreement exists on how turbulence levels will vary with qualitative analysis. It does not tie one down to specifics. When it comes to flying quality specifications, many feel that one should stay with the definitions of the Cooper-Harper rating scale but allow the levels to shift depending on the level of turbulence. There is a ride quality specification in the MIL-SPEC having to do with flight control systems design that is related to a turbulence model. This spec (MIL-F8785C) and others are discussed. Author

N87-25282*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
UNRESOLVED ISSUES IN WIND SHEAR ENCOUNTERS **c03**
Robert F. Stengel *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 197-204 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

Much remains to be learned about the hazards of low altitude wind shear to aviation. New research should be conducted on the nature of the atmospheric environment, on aircraft performance, and on guidance and control aids. In conducting this research, it is important to distinguish between near-term and far-term objectives, between basic and applied research, and between uses of results for aircraft design or for real-time implementation. Advances in on-board electronics can be applied to assuring that aircraft of all classes have near optimal protection against wind shear hazards. Author

N87-25283*# Flight Safety International, Inc., Tulsa, Okla.
SIMULATOR SYSTEMS INTEGRATION **c09**
Keith W. Shipman *In* NASA. Langley Research Center, Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 205-207 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 14B

The implementation of available wind shear data into general aviation flight training simulators is discussed. Currently, there are 11 simulators with wind shear models installed involving some 9 different aircraft models. Retrofits to other systems that were put out earlier are currently underway, and all the new simulators will have wind shear available for the instructors to use for demonstrations and training. There are three types of computer systems involved, and two different types of instructor stations. Most of the systems with wind shear are the CRT-type displays. The integration of wind shear models in flight simulators is discussed in detail. Author

N87-25284*# Alabama Univ., University. Dept. of Aerospace Engineering.
HELICOPTER-V/STOL DYNAMIC WIND AND TURBULENCE DESIGN METHODOLOGY **c05**
J. Earl Bailey *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 209-216 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

Aircraft and helicopter accidents due to severe dynamic wind and turbulence continue to present challenging design problems. The development of the current set of design analysis tools for a aircraft wind and turbulence design began in the 1940's and 1950's. The areas of helicopter dynamic wind and turbulence modeling and vehicle response to severe dynamic wind inputs (microburst type phenomena) during takeoff and landing remain as major unsolved design problems from a lack of both environmental data and computational methodology. The development of helicopter and V/STOL dynamic wind and turbulence response computation methology is reviewed, the current state of the design art in industry is outlined, and comments on design methodology are made which may serve to improve future flight vehicle design. Author

N87-25285*# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
ACCIDENT INVESTIGATION **c03**
William G. Bud Laynor *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 217-220 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

The National Transportation Safety Board (NTSB) has attributed wind shear as a cause or contributing factor in 15 accidents involving transport-categroy airplanes since 1970. Nine of these were nonfatal; but the other six accounted for 440 lives. Five of the fatal accidents and seven of the nonfatal accidents involved encounters with convective downbursts or microbursts. Of other accidents, two which were nonfatal were encounters with a frontal system shear, and one which was fatal was the result of a terrain induced wind shear. These accidents are discussed with reference to helping the aircraft to avoid the wind shear or if impossible to help the pilot to get through the wind shear. E.R.

N87-25286*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRBORNE DOPPLER RADAR FOR WIND SHEAR DETECTION **c32**
Leo Staton *In its* Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 221-23 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 17E

There has been extensive discussion concerning the use of ground based Doppler radars for the detection and measurement of microburst features and the mapping of associated wind shears. Recent and planned research at Langley into technology and techniques useful for the future development of airborne Doppler weather radar systems for both turbulence and wind shear detection are addressed. Such systems, if successfully developed, would represent a marked increase in performance over airborne weather radars currently available. A principal difficulty in extending to airborne radars the capabilities of current ground based Doppler radars is emphasized. Author

N87-25287*# United Air Lines, Inc., Denver, Colo.
UNITED AIRLINES WIND SHEAR INCIDENT OF MAY 31, 1984 **c03**
David A. Simmon *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 233-234 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

An incident involving wind shear on 31 May 1984 is discussed by an airline employee. The specs of the plane are given, the

weather conditions are listed, and the actions taken by the flight crew are discussed. E.R.

N87-25288*# National Center for Atmospheric Research, Boulder, Colo.
UNITED AIRLINES WIND SHEAR INCIDENT OF MAY 31, 1984
c03
John McCarthy *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 235 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

An incident involving wind shear which occured on 31 May 1984 on a United Airlines aircraft is discussed by a member of the National Center for Atmospheric Research. The meteorological parameters important to this incident are detailed. E.R.

N87-25289# General Accounting Office, Washington, D. C. National Security and International Affairs Div.
WEAPON SYSTEMS: STATUS OF THE ARMY'S LIGHT HELICOPTER FAMILY PROGRAM
Mar. 1987 10 p
(PB87-180063; GAO/NSIAD-87-117FS; B-222896) Avail: NTIS HC A02/MF A01 CSCL 01B

The report presents a review of the Army's Light Helicopter Family (LHX) program. The LHX program is a major Army initiative to replace its aging fleet. The Army has realized the original goals it set for the program are not likely to be achieved. It has set more realistic program goals that still represent a great challenge. The LHX is approaching a key milestone scheduled for April 1987 - the full scale development decision. At that point, program cost estimates are to be verified, requirements solidified, and a formal cost-effectiveness analysis of program alternatives completed. GRA

N87-25290# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereichsleitung Raumfahrt.
THE GERMAN AERONAUTICS AND SPACE INDUSTRY. CHANCES FOR TECHNICAL-SCIENTIFIC YOUNG TALENT [DIE DEUTSCHE LUFT- UND RAUMFAHRTINDUSTRIE - CHANCEN FUER DEN TECHNISCH-WISSENSCHAFTLICHEN NACHWUCHS]
Klaus Berge 2 Oct. 1986 16 p In GERMAN Presented at the 35th Hermann-Oberth Gesellschaft (HOG) e.V. Raumfahrtkongress, Garmisch-Partenkirchen, West Germany, 2-4 Oct. 1986
(MBB-UR-E-925/86; ETN-87-99957) Avail: Issuing Activity

The direction and management methods and the emerging technical tasks in the space industry are discussed. The role of strategic planning, leading to a different approach with respect to management practices and the equipment of offices and laboratories using computer aided communication, simulation, and computation, is emphasized. ESA

N87-25291# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
AIRCRAFT TECHNOLOGIES OF THE NINETIES IN MBB PASSENGER AIRCRAFT PROJECTS FLUGZEUG-TECHNOLOGIE DER 90ER JAHRE IN VERKEHRSFLUGZEUG-PROJEKTEN VON MBB]
Uwe Ganzer 1986 40 p In GERMAN; ENGLISH summary Presented at the DGLR-Jahrestagung, Munich, West Germany, 8-10 Oct. 1986
(MBB-UT-21/86; DGLR-86-108; ETN-87-99962) Avail: Issuing Activity

Technologies for passenger aircraft in the nineties are treated. The impact of new technologies on the economics of an aircraft is considered. The propfan propulsion concept, laminar and carbon fiber reinforced airfoils, as well as cockpit and flight control techniques are reviewed, in order to identify problems involved in the development of these techniques. ESA

N87-25292*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ON THE COALESCENCE-DISPERSION MODELING OF TURBULENT MOLECULAR MIXING
Peyman Givi and George Kosaly (Washington Univ., Seattle.) Jul. 1987 28 p
(NASA-TM-89910; ICOMP-87-3; E-3602; NAS 1.15:89910) Avail: NTIS HC A03/MF A01 CSCL 01B

The general coalescence-dispersion (C/D) closure provides phenomenological modeling of turbulent molecular mixing. The models of Curl and Dopazo and O'Brien appear as two limiting C/D models that bracket the range of results one can obtain by various models. This finding is used to investigate the sensitivtiy of the results to the choice of the model. Inert scalar mixing is found to be less model-sensitive than mixing accompanied by chemical reaction. Infinitely fast chemistry approximation is used to relate the C/D approach to Toor's earlier results. Pure mixing and infinite rate chemistry calculations are compared to study further a recent result of Hsieh and O'Brien who found that higher concentration moments are not sensitive to chemistry. Author

N87-25293*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT DURATION, AIRSPEED PRACTICES AND ALTITUDE MANAGEMENT OF AIRPLANES INVOLVED IN THE NASA VGH GENERAL AVIATION PROGRAM
Joseph W. Jewel, Jr. Aug. 1987 180 p
(NASA-TM-89074; L-16236; NAS 1.15:89074) Avail: NTIS HC A09/MF A01 CSCL 01B

Flight duration, airspeed, and altitude information obtained from NASA velocity gravity height (VGH) recorders is presented for each of 95 general aviation airplanes flown in twin- and single-engine executive, personal, instructional, commercial survey, aerial application, aerobatic, commuter, and float operations. These data complement normal acceleration data obtained from the same airplanes and reported in NASA-TM-84660, and together they provide a data base for the design and analysis of general aviation airplane operations. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N87-25294*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIND TUNNEL PERFORMANCE RESULTS OF AN AEROELASTICALLY SCALED 2/9 MODEL OF THE PTA FLIGHT TEST PROP-FAN
George L. Stefko, Gayle E. Rose, and Gary G. Podboy Jul. 1987 50 p Presented at the 23rd Joint Propulsion Conference, San Diego, Calif., 29 Jun. - 2 Jul. 1987; cosponsored by AIAA, SAE, ASME, and ASEE Prepared in cooperation with Sverdrup Technology, Inc., Cleveland, Ohio
(NASA-TM-89917; E-3610; NAS 1.15:89917; AIAA-87-1893)
Avail: NTIS HC A03/MF A01 CSCL 01A

High speed wind tunnel aerodynamic performance tests of the SR-7A advanced prop-fan have been completed in support of the Prop-Fan Test Assessment (PTA) flight test program. The test showed that the SR-7A model performed aerodynamically very well. At the cruise design condition, the SR-7A prop fan had a high measured net efficiency of 79.3 percent. R.J.F.

N87-25295*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUBSONIC WIND-TUNNEL MEASUREMENTS OF A SLENDER WING-BODY CONFIGURATION EMPLOYING A VORTEX FLAP
Neal T. Frink Jul. 1987 313 p
(NASA-TM-89101; L-16265; NAS 1.15:89101) Avail: NTIS HC A14/MF A01 CSCL 01A

(NASA-TM-89101; L-16265; NAS 1.15:89101) Avail: NTIS HC A14/MF A01 CSCL 01A

A wind tunnel study at Mach 0.4 was conducted for a slender wing-body configuration with a leading edge vortex flap of curved planform that is deflectable about a 74 degree swept hinge line. The basic data consist of a unique combination of longitudinal aerodynamic, surface pressure, and vortex flap hinge-moment measurements on a common model. The longitudinal aerodynamic, pressure and hinge-moment data are presented without analysis in tabular format. Plots of the tabulated pressure data are also given. Author

N87-25296*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PERFORMANCE AND LOADS DATA FROM A HOVER TEST OF A 0.658-SCALE V-22 ROTOR AND WING

Fort F. Felker, David B. Signor, Larry A. Young, and Mark D. Betzina Apr. 1987 468 p

(NASA-TM-89419; A-87058; NAS 1.15:89419) Avail: NTIS HC A20/MF A01 CSCL 01A

A hover test of a 0.658-scale model of a V-22 rotor and wing was conducted at the Outdoor Aerodynamic Research Facility at Ames Research Center. The primary objectives of the test were to obtain accurate measurements of the hover performance of the rotor system, and to measure the aerodynamic interactions between the rotor and wing. Data were acquired for rotor tip Mach numbers ranging from 0.1 to 0.73. This report presents data on rotor performance, rotor-wake downwash velocities, rotor system loads, wing forces and moments, and wing surface pressures. Author

N87-25297 Colorado Univ., Boulder.

EXPERIMENTAL STUDIES ON THE DYNAMIC DEVELOPMENT AND CONTROL OF UNSTEADY SEPARATED FLOWS Ph.D. Thesis

Henry Elmer Helin 1986 196 p

Avail: Univ. Microfilms Order No. DA8706426

Current research in unsteady aerodynamics revolves around the concept of enhancing aerodynamic performance through the energetic nature of vorticity dominated flowfields. It appears clear that substantial lift enhancement and stall delay are some of the beneficial consequences of certain unsteady aerodynamic conditions. However, the work in unsteady aerodynamics remains in its infancy and we cannot fully predict what the area may yield in useful consequences: but the possibilities appear promising. Before any useful scheme can be implemented a thorough understanding of the generation and control of unsteady phenomena must be obtained. Energetic vorticity dominated flows elicited through forced unsteady flow separation about a pitching airfoil were examined for a wide range of test conditions, including control oriented motion histories and model geometries. Phase locked high speed 16mm photography coupled with near-surface hot-wire anemometry and multi-port surface pressure measurements were used to quantify flowfield dynamics and the ensuing aerodynamic loading. The motion history employed as well as the model geometry had significant influences on the generation, coalescence, and convection of the vortical structures. Dissert. Abstr.

N87-25298# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

THE AERONAUTICAL RESEARCH INSTITUE (FFA) WING BODY 85 COMPUTER PROGRAM. A PANEL METHOD FOR DETERMINATION OF AEROELASTIC CHARACTERISTICS APPLYING DIRECT BLOCK ITERATIVE SOLUTION TECHNIQUES

Per Krantz Apr. 1986 15 p

(Contract FMV-F-K-82260-84260)

(FFA-TN-1986-28; ETN-87-99780) Avail: NTIS HC A02/MF A01

A panel program for calculations of aerodynamic characteristics of configurations with rigid or elastic wings was modified to handle a larger number of panels within a reasonable amount of computing time. A solution method for the equation systems is introduced and the number of operations required for solution is compared with the number needed for the old method. ESA

N87-25299# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

APPLICATION OF A THREE-DIMENSIONAL EULER CODE TO TRANSONIC BLADE TIP FLOW

Heidemarie Stahl Sep. 1986 21 p Presented at the Twelfth European Rotorcraft Forum, Garmisch-Partenkirchen, West Germany, 22-25 Sep. 1986 Sponsored by DGLR, Bonn, West Germany

(MBB-UD-482/86; ETN-87-99927) Copyright Avail: Issuing Activity

A three dimensional steady flow code for flows around fixed wings was modified for rotor flow. A method of step by step mesh refinement starting from the coarsest grid reduces the computation time usually associated with Euler codes, without reducing accuracy. A strong dependency between grid resolution and resolution of aerodynamic coefficients is shown. The grid must be large enough so that its outer boundaries can be considered to be in the undisturbed flow, so that far field conditions apply. ESA

N87-25300# Spectron Development Labs., Inc., Costa Mesa, Calif.

TOMOGRAPHIC RECONSTRUCTION OF THREE-DIMENSIONAL FLOW OVER AIRFOILS Final Report, 15 Mar. 1983 - 14 Nov. 1986

Dariush Modarress, Hung Tan, and James D. Trolinger 18 Mar. 1987 31 p

(Contract DAAG29-83-C-0012)

(AD-A179976; SDL-87-2284-13F; ARO-19471.4-EG) Avail: NTIS HC A03/MF A01 CSCL 20D

Application of holographic tomography to the flow around the tip of a revolving airfoil is investigated. Data in the form of interferograms obtained at forty different angles obtained by AVRADCOM at NASA Ames were used to reconstruct the three-dimensional density field. An automated fringe analysis capability was developed to digitize, filter and repair the fringe patterns. The binary images of the interferograms were used as the input data to the reconstruction code. A new ART code based on the iterative refinement method of least squares solution was developed for tomographic reconstruction. Solutions were obtained for the density and velocity field at various heights above the blade. An important feature of the technique was found to be that with limited resolution (say 20 x 20), it was possible to repeatedly use the same code and zoom into regions surrounding important features of the flow and, hence, reconstruct the flow field in greater detail. This feature was used and the position of the shock wave over the wing was determined. Author (GRA)

N87-25301*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

STUDY OF LEE-SIDE FLOWS OVER CONICALLY CAMBERED DELTA WINGS AT SUPERSONIC SPEEDS, PART 2

Richard M. Wood and Carolyn B. Watson Jul. 1987 404 p

(NASA-TP-2660-Pt-2; L-16192; NAS 1.60:2660-Pt-2) Avail: NTIS HC A18/MF A01 CSCL 01A

An experimental investigation was performed in which surface pressure data, flow visualization data, and force and moment data were obtained on four conical delta wing models which differed in leading edge camber only. Wing leading edge camber was achieved through a deflection of the outboard 30% of the local wing semispan of a reference 75 deg swept flat delta wing. The four wing models have leading edge deflection angles delta sub F of 0, 5, 10, and 15 deg measured streamwise. Data for the wings with delta sub F = 10 and 15 deg showed that hinge line separation dominated the lee-side wing loading and prohibited the development of leading edge separation on the deflected portion of wing leading edge. However, data for the wing with delta sub F = 5 deg showed that at an angle of attack of 5 deg, a vortex was positioned on the deflected leading edge with reattachment

at the hinge line. Flow visualization results were presented which detail the influence of Mach number, angle of attack, and camber on the lee-side flow characteristics of conically cambered delta wings. Analysis of photographic data identified the existence of 12 distinctive lee-side flow types. Author

N87-25302*# Textron Bell Helicopter, Fort Worth, Tex.
GROUND AND FLIGHT TEST RESULTS OF A TOTAL MAIN ROTOR ISOLATION SYSTEM Final Report
Dennis R. Halwes Washington NASA Jul. 1987 153 p Sponsored by Army Aerostructures Directorate
(Contract NAS1-16869)
(NASA-CR-4082; NAS 1.26:4082; Rept-699-099-055) Avail: NTIS HC A08/MF A01 CSCL 01B

A six degree-of-freedom (DOF) isolation system using six LIVE units has been installed under an Army/NASA contract on a Bell 206LM helicopter. This system has been named the Total Rotor Isolation System, or TRIS. To determine the effectiveness of TRIS in reducing helicopter vibration, a flight verification study was conducted at Bell's Flight Research Center in Arlington, Texas. The flight test data indicate that the 4/rev vibration level at the pilot's seat were suppressed below the 0.04g level throughout the transition envelope. Flight tests indicate over 95% suppression of vibration level from the rotor hub to the pilot's seat. The TRIS installation was designed with a decoupled control system and has shown a significant improvement in aircraft flying qualities, such that it permitted the trimmed aircraft to be flown hands-off for a significant period of time, over 90 seconds. The TRIS flight test program has demonstrated a system that greatly reduces vibration levels of a current-generation helicopter, while significantly improving the flying qualities to a point where stability augmentation is no longer a requirement. Author

N87-25303 ESDU International Ltd., London (England).
DRAG OF STUB WINGS AND FAIRINGS ON A FLAT PLATE WITH A TURBULENT BOUNDARY LAYER AT SUBSONIC AND SUPERSONIC SPEEDS
Nov. 1984 19 p
(ESDU-84035; ISBN-0-85679-499-6; ISSN-0141-397X) Avail: ESDU

This Data Item 84035, an addition to the Aerodynamics Sub-series, provides simple empirical methods for estimating the drag of the excrescences, either wholly or partially immersed in a turbulent boundary layer, for Mach numbers up to 3 but excluding the transonic range from 0.8 to 1.2. The methods allow determination of the drag penalty due to such fittings as blade aerials, mounting struts, and fairings over warning beacons or radar antennae. Simple expressions are given for the drag ratio (drag in the presence of the boundary layer on the mounting plate divided by drag in its absence) involving stub wind or fairing geometry, boundary layer thickness, and the effect of shear in the boundary layer for which data are provided. If not known, the drag in the absence of a boundary layer can be obtained from other ESDU documents in the Sub-series. The stub wings can have any profile but must be straight-tapered; drag coefficient based on frontal area is thought to be predicted to within 0.02 to 0.05 at subsonic or supersonic speeds respectively. The fairings can have semi-circular or non-circular cross sections and their drag coefficients based on frontal area are predicted to within o.o1 or 0.1 at subsonic or supersonic speeds respectively. ESDU

N87-25304*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECT OF PLANFORM TAPER ON HOVER PERFORMANCE OF AN ADVANCED AH-64 MODEL ROTOR
Henry L. Kelley Aug. 1987 13 p Prepared in cooperation with Army Aviation Research and Development Command, Hampton, Va.
(DA Proj. 1L1-61102-AH-45A)
(NASA-TM-89145; L-16267; NAS 1.15:89145; AVSCOM-TM-87-B-10) Avail: NTIS HC A02/MF A01 CSCL 01A

The hover performance of a 27 percent scale model baseline rotor and advanced rotor with a 3:1 tapered tip (TR3) for the AH-64 attack helicopter was investigated and compared. Hover results from a previously tested advanced rotor with a 5:1 tapered tip (TR5) were also compared. Rotor thrust was varied over a range for two tip Mach numbers. The results indicated that the TR3 blades had improved performance compared with the TR5 blades, and both the TR3 and TR5 blades were superior to the baseline rotor. The additional margin in performance for the TR3 blades was likely due to an increase in blade area and Reynolds number in the tip region of the blades. Author

N87-25305*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON THE NONLINEAR AERODYNAMIC AND STABILITY CHARACTERISTICS OF A GENERIC CHINE-FOREBODY SLENDER-WING FIGHTER CONFIGURATION
Gary E. Erickson and Jay M. Brandon Jun. 1987 38 p Prepared in cooperation with NASA- Langley Research Center, Hampton, Va.
(NASA-TM-89447; A-87174; NAS 1.15:89447) Avail: NTIS HC A03/MF A01 CSCL 01A

An exploratory investigation was conducted of the nonlinear aerodynamic and stability characteristics of a tailless generic fighter configuration featuring a chine-shaped forebody coupled to a slender cropped delta wing in the NASA Langley Research Center's 12-Foot Low-Speed Wind Tunnel. Forebody and wing vortex flow mechanisms were identified through off-body flow visualizations to explain the trends in the longitudinal and lateral-directional characteristics at extreme attitudes (angles of attack and sideslip). The interactions of the vortical motions with centerline and wing-mounted vertical tail surfaces were studied and the flow phenomena were correlated with the configuration forces and moments. Single degree of freedom, free-to-roll tests were used to study the wing rock susceptibility of the generic fighter model. Modifications to the nose region of the chine forebody were examined and fluid mechanisms were established to account for their ineffectiveness in modulating the highly interactive forebody and wing vortex systems. Author

N87-25306*# National Aeronautics and Space Administration, Washington, D.C.
RECENT PROGRESS IN THE MEASUREMENT OF THE DRAG COEFFICIENTS OF MODELS OF TRANSPORT AIRCRAFT IN A WIND TUNNEL
C. Armand, P. Hugouvieux, and R. Selvaginni Aug. 1987 57 p Transl. into ENGLISH of conference paper Progres Recents dans la Mesure en Soufflerie du Coefficient de Trainee de Maquettes d'Avion de Transport presented at the 23rd Symposium of Applied Aerodynamics, 1980 p 1-47 Symposium held in Aussois, France, 12-14 Nov. 1986 Original language document was announced in IAA as A87-21070 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TT-20096; NAS 1.77:20096; ONERA-TP-1986-170) Avail: NTIS HC A04/MF A01 CSCL 01A

Techniques and apparatus employed by ONERA researchers at Mondane to obtain an accuracy of 0.0001 in drag measurements on scale models of transport aircraft are described. Emphasis is placed on cruise flight configurations for the Airbus, and on the computational methods applied to correct the data for scale models to account for wind tunnel effects, as opposed to aircraft in actual flight. Model design, the mounts used, calibration of the balances and the angle of attack, and the data acquisition and treatment systems are summarized. Methods used to offset the thermal friction, wall and support effects on the flowfield are discussed. Author

N87-25307*# National Aeronautics and Space Administration, Washington, D.C.
THE INTERFERENCE OF THE MODEL SUPPORT MAST WITH MEASUREMENTS OF THE LONGITUDINAL AND LATERAL AERODYNAMIC COEFFICIENTS

C. VandeKreeke, J. Verriere, and G. Quemard Aug. 1987 32 p Transl. into ENGLISH of conference paper Interaction d'un Mat Support de Maquette sur les Mesures des Coefficients Aerodynamiques Longitudinaux presented at the 23rd Colloque d'Aerodynamique Appliquee, 1986 28 p Colloquium held in Aussois, France, 12-14 Nov. 1986 Original language document was announced in IAA as A87-21080 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TT-20079; NAS 1.77:20079; ONERA-TP-1986-181) Avail: NTIS HC A03/MF A01 CSCL 01A

The effects the single-bottom support masts used in the ONERA S1 and S4 wind tunnels have on aerodynamic data collected with scale model aircraft were examined experimentally and analytically. Systematic studies were performed on the flow characteristics around different diameters for the mounts. Scaling methods used to make data from one wind tunnel correspond to data from the other are described. Airbus 320 models were introduced into the tests and mast-body flow interactions were observed. A summary is presented of restrictions on the mast diameters, relative to cylindrical model diameters, which will minimize the effects the masts have on longitudinal and lateral aerodynamic stability data. Author

N87-25501# Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF HYPERSONIC FLOW PAST MODELS IN WIND TUNNELS OF VARIOUS TYPES
V. I. Alferov, A. N. Labazkin, and A. P. Rudakova *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 66 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Mekhanika Zhidosti i Gaza (Moscow, USSR), no. 2, Mar. - Apr. 1986 p 181-184 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N87-25308# Lockheed-California Co., Burbank.
KRASH ANALYSIS CORRELATION. TRANSPORT AIRPLANE CONTROLLED IMPACT DEMONSTRATION TEST Final Report, Feb. - Aug. 1985
Gil Wittlin Dec. 1986 125 p
(Contract DTFA03-84-C-00004)
(AD-A179906; LR-30916; DOT/FAA/CT-86-13) Avail: NTIS HC A06/MF A01 CSCL 01B

The analyses results of a transport airplane Controlled Impact Demonstration (CID) test using programs KRASH are described. Pre-CID analyses, presented in FAA technical report DOT/FAA/CT-85/9, are provided in summary form. The KRASH post CID correlation consists of modeling two sequences; a symmetrical impact of the fuselage with the ground (after engine-loss at initial air-to-ground impact) and the unsymmetrical air-to-ground including initial engine ground contact and subsequent fuselage impact with the ground. The analyses and test results are compared with regard to floor acceleration responses, fuselage shear and bending moment distribution, wing and engine acceleration responses, wing bending moment distribution, structural failures, fuselage underside crush, and sequence of events. GRA

N87-25309# Kentucky Univ., Lexington. Dept. of Mechanical Engineering.
DETERMINATION OF THE LOCAL HEAT TRANSFER CHARACTERISTICS ON GLAZE ICE ACCRETIONS ON A CYLINDER AND A NACA 0012 AIRFOIL Final Report, May 1983 - Sep. 1986
M. R. Pais and S. N. Singh Apr. 1987 74 p
(Contract F33615-83-C-3013)
(AD-A179931; AFWAL-TR-87-3001) Avail: NTIS HC A04/MF A01 CSCL 20D

In recent years, the problem of ice formation on aircraft has received considerable attention because of its influence on military aircraft capabilities. Military aircraft and helicopters may be required to operate under icing conditions which would effect their performance, maneuverability and impair the mechanical integrity of unprotected engines. Ice formation poses a hazard to flight in that it alters the aerodynamic characteristics of lifting surfaces, reducing the maximum lift and sharply increasing the drag. In addition the ice formation may lead to control problems and, if it sloughs off, damage structures downstream. The above situations can cause serious problems for military aircraft or missiles flying over the North Atlantic and North Sea. In Europe in winter it is possible to have the proper weather conditions for ice formation up to 30 percent of the time. The ice accretion process is of prime interest in aircraft design. In order to develop and then certify certain protection systems 11-16, it is necessary to be able to test engine intakes, aerofoils in simulated icing conditions. GRA

N87-25310# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT/INCIDENT SUMMARY REPORTS: UNALASKA, ALASKA, SEPTEMBER 25, 1985; JENKINSBURG, GEORGIA, SEPTEMBER 29, 1985; BOSTON, MASSACHUSETTS, DECEMBER 15, 1985; DEKALB, TEXAS, DECEMBER 31, 1985; ERIE, PENNSYLVANIA, FEBRUARY 21, 1986
30 Jun. 1987 48 p
(PB87-910408; NTSB/AAR-87/02/SUM) Avail: NTIS HC A03/MF A01 CSCL 01C

A compilation of reports of aviation accidents investigated by the National Transportation Safety Board is presented. The accident locations and dates are: Unalaska, Alaska, September 25, 1985; Jenkinsburg, Georgia, September 29, 1985; Boston, Massachusetts, December 15, 1985; DeKalb, Texas, December 31, 1985; and Erie, Pennsylvania, February 21, 1986. Author

N87-25311# National Transportation Safety Board, Washington, D. C. Bureau of Safety Programs.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA. US AIR CARRIER OPERATIONS CALENDAR YEAR 1983
13 Feb. 1987 112 p
(PB87-160628; NTSB/ARC-87-01) Avail: NTIS HC A06/MF A01 CSCL 01C

The record of aviation accidents involving revenue operations of U.S. air carriers and on demand air taxis for calendar year 1983 is given. Tables are presented to describe the losses and characteristics of the 1983 accidents to enable comparisons with prior years. GRA

N87-25282*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
UNRESOLVED ISSUES IN WIND SHEAR ENCOUNTERS
Robert F. Stengel *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 197-204 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

N87-25285*# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
ACCIDENT INVESTIGATION
William G. Bud Laynor *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 217-220 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

N87-25287*# United Air Lines, Inc., Denver, Colo.
UNITED AIRLINES WIND SHEAR INCIDENT OF MAY 31, 1984
David A. Simmon *In* NASA. Langley Research Center Wind

Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 233-234 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

N87-25268*# National Center for Atmospheric Research, Boulder, Colo.
UNITED AIRLINES WIND SHEAR INCIDENT OF MAY 31, 1984
John McCarthy *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 235 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

N87-25312# Federal Aviation Agency, Atlantic City, N.J.
HELIPORT VISUAL APPROACH SURFACE TESTING TEST PLAN
Rosanne M. Weiss and John R. Sackett Feb. 1987 31 p
(AD-A179897; DOT/FAA/CT-TN86/61) Avail: NTIS HC A03/MF A01 CSCL 01D

This Technical Note identifies procedures to be used during tests to be conducted at the Federal Aviation Administration Technical Center. These tests are designed to test the applicability of existing heliport approach and departure surface criteria. Three different types of aircraft will be used. GRA

N87-25313# Test Wing (4950th), Wright-Patterson AFB, Ohio.
TACAN/INS PERFORMANCE EVALUATION (TIPE) FLIGHT TEST REPORT Report, 29 Apr. - 24 May 1986
Christopher J. McCormack 22 Jan. 1987 43 p
(AD-A180138; Rept-4950/FTR-86-10) Avail: NTIS HC A03/MF A01 CSCL 17G

The TACAN/INS Performance Evaluation test program investigated the feasibility of test missions requiring aircraft position information without using dedicated ground based tracking radars. This test examined the accuracy of the aircraft's TACAN receiver and on board inertial navigation system by comparing data from these airborne systems with information from a ground based precision laser tracker. Data analysis concentrated on the distance measuring equipment information from the TACAN transceiver. The report contains a summary of the data collected as well as a description of the data reduction techniques, including dual DME position fixing and three dimensional coordinate transformations. The results indicate that a dual TACAN positioning system can provide accurate position fixing. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.* For land transportation vehicles see *85 Urban Technology and Transportation.*

N87-25314 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
A MODEL TEST VEHICLE FOR HYPERSONIC AEROSPACE SYSTEMS DEVELOPMENT
H. Grallert, G. Cucinelli, and M. Rigault 1986 13 p Presented at the 37th International Astronautical Federation Congress on Space: New Opportunities for All People, Innsbruck, Austria, 4-11 Oct. 1986 Previously announced in IAA as A87-15882 Submitted for publication
(MBB-UR-875/86; IAF-86-125; ETN-87-99937) Copyright Avail: Issuing Activity

The use of a hypersonic test vehicle in the Hermes space shuttle development program is proposed. The technical, safety, and cost justifications of such an approach are outlined. The MAIA 1:3 scale model of Hermes is described. ESA

N87-25315# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Helicopter Div.
DESIGN FOR REPAIRABILITY OF HELICOPTER ROTOR BLADES
M. Hahn 1986 17 p Presented at the 62nd AGARD Meeting of the Structures and Materials Panels Specialists' Meeting, Oslo, Norway, 14-18 Apr. 1986
(MBB-UD-491/86; ETN-87-99931) Copyright Avail: Issuing Activity

Repairability criteria for helicopter main rotors are described, and repair procedures are outlined. Service experience with main and tail rotors is reviewed. ESA

N87-25316# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
DESIGN OF A COMPOSITE TAIL FOR THE AIRBUS A-320
H. Brenneis 1986 24 p Presented at the 15th International Council of the Aeronautical Sciences (ICAS) Congress, London, England, 7-12 Sep. 1986
(MBB-UT-12-86; ICAS-86-4.3.5; ETN-87-99958) Avail: Issuing Activity

A CFRP tail was built for the A-320 aircraft. The modular design involves wrapping the CFRP fabric around metallic cores, pressed together to obtain the desired geometry. The required thicknesses are obtained by different thermal expansion between the metal cores and the bonding tool made from CFRP-prepreg during the cure cycle at 125 C and 10 bar. No repairs caused by cracks or delaminations are reported after 120,000 life cycle tests, i.e., the equivalent of 3 aircraft life cycles. ESA

N87-25317# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
A310-300 CFRP FIN DAMAGE TOLERANCE DEMONSTRATION
O. Goekgoel 1986 23 p Presented at the 7th International Conference SAMPE European Chapter, Munich, West Germany
(MBB-UT-015/86; ETN-87-99959) Avail: Issuing Activity

An approach for the determination of appropriate validation loads for given inspection intervals to demonstrate acceptable low level of risk in service of CFRP fin is outlined. The inspection intervals for metal fins are applied to the CFRP fin. ESA

N87-25318# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
CORRELATION OF B-1 FLIGHT TEST SUBJECTIVE ASSESSMENTS AND SOME RIDE QUALITY/VIBRATION EXPOSURE CRITERIA Final Report, Mar. 1982 - Jun. 1985
John W. Rustenburg May 1986 103 p
(AD-A179844; ASD-TR-85-5015) Avail: NTIS HC A06/MF A01 CSCL 01C

This study reviews several methods for describing the intensity of a vibration of ride-quality environment and its effect and comfort, proficiency and fatigue. These methods are applied to vibration environments encountered during B-1 low-altitude, high-speed flight tests. The resulting vibration environment/ride quality descriptions are correlated with qualitative assessments of turbulence levels and impact on performance and discomfort obtained from the crew. This correlation provides an evaluation of the sensitivity of the methods in predicting the effects of variation in the vibration environment. To evaluate the precision of the methods in predicting ride quality ratings for a high-speed low-altitude environment, the qualitative assessments of the crew are compared to ratings, boundaries or limits established by the different methods. GRA

N87-25319# Fluidyne Engineering Corp., Minneapolis, Minn.
HIGH-TEMPERATURE TEST TECHNOLOGY Final Report, Sep. 1984 - Jan. 1986
Henry A. Hanson and John J. Casey Mar. 1987 178 p
(Contract F33615-84-C-3213)
(AD-A179932; AFWAL-TR-86-3105) Avail: NTIS HC A09/MF A01 CSCL 01C

This report describes the findings of a study to determine the state of the art for high-temperature (1000-3000 F) fatigue and static testing of full-scale aerospace vehicle structures and structural components. Facilities, test equipment, instrumentation and test methods currently used by government, industry, and research organizations were surveyed and their capabilities evaluated. The purpose of this survey was to determine what state of the art techniques, equipment, and transducers are available for use in high-temperature structural testing, and to determine if there are any vacuum and cryogenic facilities available which could be adapted for use in high-temperature testing of full-scale aerospace vehicle structures and components containing liquid hydrogen. Recommendations are made for development work in order to establish or enhance the basic capabilities required to meet these needs. GRA

N87-25320*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A MULTI-BODY AIRCRAFT WITH AN ALL-MOVABLE CENTER FUSELAGE ACTIVELY CONTROLLING FUSELAGE PRESSURE DRAG Patent Application
Richard M. Wood, inventor (to NASA) 12 Feb. 1987 16 p
(NASA-Case-LAR-13511-1; US-Patent-Appl-SN-013801) Avail: NTIS HC A02/MF A01 CSCL 01C

A multi-body aircraft with an all-movable center fuselage which translates relative to two side fuselages is described. At subsonic and transonic flight the center fuselage is in a forward position. At supersonic speeds the center fuselage moves aft so as to ensure optimum aerodynamic interference at particular Mach numbers. This provides an increased shock strength and greater surface areas so the significant reductions in zero-lift wave drag can be achieved. This concept allows for a significant increase in the wing aspect ratio which would improve high-lift performance at all speeds without incurring a significant supersonic zero-lift wave drag penalty. In additions, an improved low-fineness ratio, high-speed performance is achieved at all speeds and for all flight conditions. NASA

N87-25321*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INTEGRALLY-STIFFENED CRASH ENERGY-ABSORBING SUBFLOOR BEAM STRUCTURE Patent Application
Gary L. Farley, inventor (to NASA) 19 May 1987 12 p
(NASA-Case-LAR-13697-1; US-Patent-Appl-SN-051426) Avail: NTIS HC A02/MF A01

An integrally-stiffened crash energy-absorbing subfloor beam is disclosed which provides increased energy absorption efficiency and ease of fabrication while uncoupling the design parameters for energy absorption and structural stiffness. The invention comprehends a beam web integrally stiffened by an assembly of vertically oriented tubular stiffeners, interconnected by vertical flat plates and top and bottom beam caps. The tubular stiffeners are of arbitrary cross-sectional shape. Typical materials for the beam are any ductile metallic (aluminum) or non-metallic materials or fiber reinforced composite material (Graphite/Epoxy and Kevlar/Epoxy). A subfloor structure is built by arranging the beams into a grid or latticework configuration such that the flat plates between the tubular stiffeners are oriented vertically. A rigid floor surface is attached over this grid of beams to complete a lower fuselage structure. NASA

N87-25276*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
B-57B GUST GRADIENT PROGRAM
Dennis W. Camp *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 117-124 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

N87-25281*# Calspan Corp., Buffalo, N. Y.
MILITARY SPECIFICATIONS
Philip Reynolds *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 181-195 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

N87-25284*# Alabama Univ., University. Dept. of Aerospace Engineering.
HELICOPTER-V/STOL DYNAMIC WIND AND TURBULENCE DESIGN METHODOLOGY
J. Earl Bailey *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 209-216 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N87-25322# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHINESE-MADE HORIZON DISPLAY SYSTEM
Liyun Xi and Fuhui Xu 23 Apr. 1987 8 p Transl. into ENGLISH from Guoji Hangkong (China), v. 10, no. 284, Oct. 1986 (AD-A180428; FTD-ID(RS)T-0282-87) Avail: NTIS HC A02/MF A01 CSCL 19E

After a successful flight test, a series of improvements on the horizon Display Fire Control System developed by the Electro Optical Research Institute of the Chinese Aeronautic Industrial Department were conducted. The three components are pilot display unit, pilot control box, and electronic assembly. The original large computer was replaced by a multiple microprocessor system. This new system passed firing practice flight tests successfully. Besides an adapting flight, photo shooting tests, inspections of its navigation function, tests of a tracer shell inspecting hot line, the continuous calculating impact points (CCIP) in air to ground shooting tests by live firing, missiles and bombs, as well as tests of horizon continuous release points (CCRP) were also conducted. Results showed the system functions were satisfactory. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxilliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N87-25323*# Garrett Turbine Engine Co., Phoenix, Ariz.
COMPOUND CYCLE ENGINE FOR HELICOPTER APPLICATION
Jere G. Castor 25 Apr. 1986 12 p
(Contract NAS3-24346; DA Proj. 1L1-61102-AH-45)
(NASA-CR-175110; NAS 1.26:175110; AD-A180007; USAAVSCOM-TR-86-C-15) Avail: NTIS HC A02/MF A01 CSCL 21E

The Compound Cycle Engine (CCE) is a highly turbocharged, power compounded, ultra-high power density, light-weight diesel engine. The turbomachinery is similar to a moderate pressure ratio,

free power turbine engine and the diesel core is high speed and a low compression ratio. This engine is considered a potential candidate for future military light helicopter applications. This executive summary presents cycle thermodynamic (SFC) and engine weight analyses performed to establish general engine operating parameters and configuration. An extensive performance and weight analysis based on a typical two hour helicopter (+30 minute reserve) mission determined final conceptual engine design. With this mission, CCE performance was compared to that of a T-800 class gas turbine engine. The CCE had a 31% lower-fuel consumption and resulted in a 16% reduction in engine plus fuel and fuel tank weight. Design SFC of the CCE is 0.33 lb-HP-HR and installed wet weight is 0.43 lbs/HP. The major technology development areas required for the CCE are identified and briefly discussed. GRA

N87-25324# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
AERODYNAMIC LOSS SOURCES IN AXIAL-FLOW COMPRESSORS Final Report, 6 Jan. 1983 - 31 Aug. 1986
T. H. Okiishi and G. K. Serovy 31 Dec. 1986 38 p
(Contract F49620-83-K-0023)
(AD-A180009; ISU-ERI-AMES-87168; TCRL-34; AFOSR-87-0559TR) Avail: NTIS HC A03/MF A01 CSCL 21E

Research related to understanding and modeling aerodynamic loss production in axial-flow compressors was accomplished. Some progress in clarification of loss prediction was attained. Suggestions for incorporating wake interaction effects in axial-flow compressor design calculations are offered. Some of the inherent complications associated with supersonic blade testing are noted. Further study of specific details of loss generation is proposed. GRA

N87-25325# United Technologies Research Center, East Hartford, Conn.
THE UNSTEADY FLOW IN THE FAR FIELD OF AN ISOLATED BLADE ROW Final Report, Sep. 1985 - Apr. 1987
Joseph M. Verdon Apr. 1987 69 p
(Contract N00014-85-C-0702)
(AD-A180201; UTRC/R87-957333-1) Avail: NTIS HC A04/MF A01 CSCL 20D

This report describes a theoretical investigation of the unsteady flow in the far field of an isolated two-dimensional blade row. In particular, analytic far-field solutions are derived for cascades operating at subsonic, transonic and supersonic inlet and exit Mach numbers. These solutions describe the velocity potential fluctuations associated with irrotational pressure (acoustic) disturbances, rotational velocity disturbances and the vorticity shed from blade trailing edges and convected along blade wakes. As such they provide the inlet and exit information needed for a successful numerical resolution of the unsteady flow through the cascade. As part of this investigation a convenient method for classifying unsteady excitations, based on the acoustic response in the far field, is provided. Also, analytical results are presented to illustrate subsonic and supersonic far-field acoustic response behavior and numerical solutions have been determined for subsonic compressor cascades to demonstrate partially the impact of unsteady far-field behavior on the aerodynamic response at a vibrating blade surface. GRA

N87-25326# Ecole Polytechnique Federale de Lausanne (Switzerland). Lab. de Thermique Appliquee.
AEROELASTICITY IN TURBOMACHINES COMPARISON OF THEORETICAL AND EXPERIMENTAL CASCADE RESULTS. APPENDIX A5: ALL EXPERIMENTAL AND THEORETICAL RESULTS FOR THE 9 STANDARD CONFIGURATIONS Final Report, 2 May 1984 - 1 Nov. 1985
A. Boelcs and T. H. Fransson 1986 422 p
(Grant AF-AFOSR-0105-84)
(AD-A180534; AFOSR-87-0605TR-App-A-5) Avail: NTIS HC A18/MF A01 CSCL 20D

Reliable, efficient methods are needed for calculating unsteady blade forces in turbomachines. The validity of such theoretical or empirical prediction models can be established only if their flutter and forced vibration predictions are applied to a number of well documented experimental test cases. In this report, the geometrical and time average flow conditions of nine two dimensional and quasi-three dimensional experimental (mainly) standard configurations for aeroelasticity in turbomachine cascades are given. Some aeroelastic test cases are defined for each configuration, comprising different incidence angles, Mach numbers, interblade phase angle, reduced frequencies, etc. The comparative investigation has shown that present theoretical models can predict accurately the aeroelastic behavior of certain cascade configurations in two dimensional flow. Other configurations cannot be predicted as well. It is concluded that, although present methods can predict stability limits in some cases, the physical reasons for flutter in cascades are not yet fully understood. GRA

N87-25327# Massachusetts Inst. of Tech., Cambridge. Gas Turbine Lab.
RESEARCH IN TURBOMACHINERY FLOWS Final Technical Report, 10 Jan. 1985 - 9 Jul. 1986
Edward M. Greitzer 15 Apr. 1987 3 p
(Grant AF-AFOSR-0114-85)
(AD-A180613; AFOSR-87-0609TR) Avail: NTIS HC A02/MF A01 CSCL 13G

This grant was issued for the purpose of purchasing a laser anemometer system to be used in carrying out unsteady velocity measurements in turbomachines. GRA

N87-25328*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
REVOLUTIONARY OPPORTUNITIES FOR MATERIALS AND STRUCTURES STUDY
F. A. Schweiger Feb. 1987 169 p
(Contract NAS3-24622)
(NASA-CR-179642; NAS 1.26:179642) Avail: NTIS HC A08/MF A01 CSCL 21E

The revolutionary opportunities for materials and structures study was performed to provide Governement and Industry focus for advanced materials technology. This study covers both subsonic and supersonic engine studies and aircraft fuel burn and DOC evaluation. Year 2010 goal materials were used in the advanced engine studies. These goal materials and improved component aero yielded subsonic fuel burn and DOC improvements of 13.4% and 5%, respectively, and supersonic fuel burn and DOC improvements of 21.5% and 18%, respectively. Conclusions are that the supersonic study engine yielded fuel burn and DOC improvements well beyond the program goals; therfore, it is appropriate that advanced material programs be considered. Author

N87-25329*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIBER-OPTIC TEMPERATURE SENSOR USING A SPECTRUM-MODULATING SEMICONDUCTOR ETALON
Glenn Beheim, Klaus Fritsch, and Donald J. Anthan (Cleveland State Univ., Ohio.) 1987 22 p Presented at the O-E/Fibers '87 Symposium on Fiber Optics and Integrated Optoelectronics, San Diego, Calif., 16-21 Aug. 1987; sponsored by SPIE and International Society for Optical Engineering
(NASA-TM-100153; E-3715; NAS 1.15:100153) Avail: NTIS HC A02/MF A01 CSCL 21E

Described is a fiber-optic temperature sensor that uses a spectrum modulating SiC etalon. The spectral output of this type of sensor may be analyzed to obtain a temperature measurement which is largely independent of the transmission properties of the sensor's fiber-optic link. A highly precise laboratory spectrometer is described in detail, and this instrument is used to study the properties of this type of sensor. Also described are a number of different spectrum analyzers that are more suitable for use in a practical thermometer. Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N87-25330*# Manudyne Systems, Inc., Los Altos, Calif.
STUDY OF HELICOPTERROLL CONTROL EFFECTIVENESS CRITERIA Final Report, Jul. 1983 - Jul. 1985
Robert K. Heffley, Simon M. Bourne, Howard C. Curtiss, Jr., William S. Hindson, and Ronald A. Hess Apr. 1986 267 p
(Contract NAS2-11665; DA Proj. 1L1-62209-AH-76)
(NASA-CR-177404; NAS 1.26:177404; AD-A172111; MANUDYNE-83-1; USAAVSCOM-TR-85-A-5) Avail: NTIS HC A12/MF A01 CSCL 01C

A study of helicopter roll control effectiveness based on closed-loop task performance measurement and modeling is presented. Roll control critieria are based on task margin, the excess of vehicle task performance capability over the pilot's task performance demand. Appropriate helicopter roll axis dynamic models are defined for use with analytic models for task performance. Both near-earth and up-and-away large-amplitude maneuvering phases are considered. The results of in-flight and moving-base simulation measurements are presented to support the roll control effectiveness criteria offered. This Volume contains the theoretical analysis, simulation results and criteria development. Author (GRA)

N87-25331*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED DETECTION, ISOLATION AND ACCOMMODATION OF SENSOR FAILURES: REAL-TIME EVALUATION
Walter C. Merrill, John C. DeLaat, and William M. Bruton Jul. 1987 30 p
(NASA-TP-2740; E-3479; NAS 1.60:2740) Avail: NTIS HC A03/MF A01 CSCL 01C

The objective of the Advanced Detection, Isolation, and Accommodation (ADIA) Program is to improve the overall demonstrated reliability of digital electronic control systems for turbine engines by using analytical redundacy to detect sensor failures. The results of a real time hybrid computer evaluation of the ADIA algorithm are presented. Minimum detectable levels of sensor failures for an F100 engine control system are determined. Also included are details about the microprocessor implementation of the algorithm as well as a description of the algorithm itself. Author

N87-25279*# Sperry Flight Systems, Glendale, Ariz. Avionics Div.
AUTOMATIC SYSTEMS AND THE LOW-LEVEL WIND HAZARD
Dwight R. Schaeffer *In* NASA. Langley Research Center, Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 165-172 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N87-25332*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
TECHNICAL BACKGROUND FOR A DEMONSTRATION MAGNETIC LEVITATION SYSTEM
Colin P. Britcher May 1987 38 p
(Grant NAG1-716)
(NASA-CR-178301; NAS 1.26:178301) Avail: NTIS HC A03/MF A01 CSCL 14B

A preliminary technical assessment of the feasibility of a demonstration Magnetic Levitation system, required to support aerodynamic models with a specified clear air volume around them, is presented. Preliminary calculations of required sizes of electromagnets and power supplies are made, indicating that the system is practical. Other aspects, including model position sensing and controller design, are briefly addressed. Author

N87-25333# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
THE ROLE OF SIMULATION IN HELICOPTER DEVELOPMENT [DIE ROLLE DER SIMULATION IN DER HUBSCHRAUBERENT-WICKLUNG]
Huber and Krauspe 1986 31 p In GERMAN Presented at the 16th Internat. Hubschrauberforum Bueckeburg, Hanover, West Germany, 11-12 Jun. 1986; and at the AGARD FMP Lecture Series No. 139 on Helicopter Aeromechanics
(MBB-UD-435/86; ETN-87-99925) Avail: Issuing Activity

Real time ground-based and flight simulation for helicopter development are reviewed. Simulators are listed. ESA

N87-25334* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRFOIL FLUTTER MODEL SUSPENSION SYSTEM Patent
Wilmer H. Reed, inventor (to NASA) (DEI-Tech, Inc., Newport News, Va.) 28 Jul. 1987 9 p Filed 30 Jul. 1986 Supersedes N86-31594 (24 - 23, p 3560)
(NASA-Case-LAR-13522-1-SB; US-Patent-4,682,494; US-Patent-Appl-SN-890575; US-Patent-Class-73-147; US-Patent-Class-73-856) Avail: Issuing Activity CSCL 14B

A wind tunnel suspension system for testing flutter models under various loads and at various angles of attack is described. The invention comprises a mounting bracket assembly affixing the suspension system to the wind tunnel, a drag-link assembly and a compound spring arrangement comprises a plunge spring working in opposition to a compressive spring so as to provide a high stiffness to trim out steady state loads and simultaneously a low stiffness to dynamic loads. By this arrangement an airfoil may be tested for oscillatory response in both plunge and pitch modes while being held under high lifting loads in a wind tunnel.
Official Gazette of the U.S. Patent and Trademark Office

N87-25335*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ARCJET POWER SUPPLY AND START CIRCUIT Patent Application
Robert P. Gruber, inventor (to NASA) 10 Jun. 1987 10 p
(NASA-Case-LEW-14374-1; US-Patent-Appl-SN-060200) Avail: NTIS HC A02/MF A01 CSCL 14B

A dc power supply for spacecraft arcjet thrusters has an integral automatic starting circuit and an output averaging inductor. The output averaging inductor, in series with the load, provides instantaneous current control, and ignition pulse and an isolated signal proportional to the arc voltage. A pulse width modulated converter, close loop configured, is also incorporated to give fast response output current control. NASA

N87-25275*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATION OF DATA TO PILOTED SIMULATORS
Richard S. Bray *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 97-115 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 14B

N87-25278*# Boeing Commercial Airplane Co., Seattle, Wash.
MICROBURST MODEL REQUIREMENTS FOR FLIGHT SIMULATION: AN AIRFRAME MANUFACTURER'S PERSPECTIVE

Richard L. Schoenman *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 153-164 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 14B

N87-25280*# CAE Industries, Ltd., Montreal (Quebec).
SIMULATOR MANUFACTURERS' REQUIREMENTS
David R. Reilly *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 173-180 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 14B

N87-25283*# Flight Safety International, Inc., Tulsa, Okla.
SIMULATOR SYSTEMS INTEGRATION
Keith W. Shipman *In* NASA. Langley Research Center, Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 205-207 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 14B

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N87-25336# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Attitude Control Dept.
END EFFECTOR DEVELOPMENT STUDY, VOLUME 1 Final Report
Aad vanSwieten Paris, France ESA 15 Jul. 1986 162 p
(Contract ESA-1682/84-NL-AN)
(FOK-TR-R-86-091-Vol-1; ESA-CR(P)-2346-Vol-1; ETN-87-99886)
Avail: NTIS HC A08/MF A01

The application of an end-effector mounted on a service manipulator system was investigated, and requirements for the service end-effector subsystem for in-orbit servicing, comprising the end-effector and the associated tools to perform the tasks, were identified. As a result of trade-offs a design was selected, and was developed further resulting in a new design with assembly drawings of the basic end-effector containing the grapple mechanism, the grapple fixture, the integrated service tool, the connector drive unit and the electronic box. The service tools, the definition of the interface between grapple fixture and service tool or orbit replaceable unit, the locking of the service tool in the tool rack for the back-up integrated service tool, and two preliminary designs of service tools, i.e., the multifunctional gripper and the angled wrench, are described. ESA

N87-25337# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Attitude Control Dept.
END EFFECTOR DEVELOPMENT STUDY. VOLUME 3: APPENDICES Final Report
Aad vanSwieten Paris, France ESA 15 Jul. 1986 235 p
(Contract ESA-1682/84-NL-AN)
(FOK-TR-R-86-091-Vol-3; ESA-CR(P)-2346-Vol-3; ETN-87-99888)
Avail: NTIS HC A11/MF A01

This third of three volumes presents the appendices of the other two volumes. The design rationale of the end effector concept; the multifunctional gripper; the angled wrench; logistic operations; maintenance and repair; assembly; and electrical architecture are discussed. ESA

N87-25338* National Aeronautics and Space Administration, Washington, D.C.
TECHNOLOGY FOR LARGE SPACE SYSTEMS: A BIBLIOGRAPHY WITH INDEXES
May 1987 182 p
(NASA-SP-7046(16); NAS 1.21:7046(16)) Avail: NTIS HC A09 CSCL 22A

This bibliography lists 673 reports, articles and other documents introduced into the NASA scientific and technical information system between July 1, 1986 and December 31, 1968. Its purpose is to provide helpful information to the researcher, manager, and designer in technology development and mission design according to system interactive analysis and design, structural and thermal analysis and design, structural concepts and control systems, electronics, advanced materials, assembly concepts, propulsion, and solar power satellite systems. Author

N87-25339*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TRACK AND CAPTURE OF THE ORBITER WITH THE SPACE STATION REMOTE MANIPULATOR SYSTEM
E. M. Bains (Lockheed Engineering and Management Services Co., Inc., Houston, Tex.), C. R. Price, and L. M. Walter May 1987 20 p
(Contracts NAS9-17900; NAS9-15800)
(NASA-TM-89221; NAS 1.15:89221) Avail: NTIS HC A02/MF A01 CSCL 22A

Results of the first study using the real-time, man-in-the-loop Systems Engineering Simulator (SES) for track and capture of the Space Shuttle Orbiter with the space station manipulator are presented. The objectives include evaluation of the operational coordination required between the orbiter pilot and the space station manipulator operator, evaluation of the locations and required number of closed-circuit television cameras, and evaluation of the orbiter grapple fixture clearance geometry. The SES is a premium quality real-time facility with full fidelity orbiter and space station crew workstations and cockpits. Author

N87-25340# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
BOTANICAL PAYLOADS FOR PLATFORMS AND SPACE STATIONS [BOTANISCHE NUTZLASTEN FUER PLATTFORMEN UND RAUMSTATIONEN]
Helmut R. Loeser 1986 10 p In GERMAN Presented at the 35th Hermann-Oberth-Gesellschaft (HOG) e.V. Raumfahrtkongress, Garmisch-Partenkirchen, West Germany, 2-4 Oct. 1986
(MBB-UR-E-921/86; ETN-87-99954) Avail: Issuing Activity

The development of botanical orbital experiments for space platforms (EURECA) and space stations (Columbus) is presented. The scientific purposes of botanical payloads are outlined. The technological challenges for engineering brought about by such payloads are discussed. Two payloads in the engineering phase, the botany facility for the second EURECA mission, and the gravitational biology facility for the experiments module of Columbus, are presented, as well as their life support systems; the requirements and the solution concepts are discussed. ESA

N87-25368# Centre National d'Etudes Spatiales, Toulouse (France).
TOOLS FOR INTERPLANETARY MISSION ANALYSIS
F. Bonneau, J. Bernard, and J. Foliard *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 109-113 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25899*# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Electrical Engineering.
ANALYSIS OF THE CONTINUOUS STELLAR TRACKING ATTITUDE REFERENCE (CSTAR) ATTITUDE RATE PROCESSOR
J. Uhde-Lacovara *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 29 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 29 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 22A

N87-25956# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
TV EXPERIMENT IN VEGA MISSION: STRATEGY, HARDWARE, SOFTWARE
R. Z. Sagdeev, G. A. Avanesov, I. V. Barinov, V. I. Kostenko, V. A. Krasikov, V. A. Shamis, K. G. Sukhanov, V. I. Tarnopolsky, Yu. K. Zaiko, S. I. Zatsepin et al. *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 289-294 (For primary document see N87-25908 19-90)
Copyright Avail: NTIS HC A20/MF A01; print copy avail. from EPD, ESTEC, Noordwijk, The Netherlands Dfl 175 (3 volumes)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

N87-25341*# Ohio State Univ., Columbus. ElectroScience Lab.
A SATELLITE SYSTEM SYNTHESIS MODEL FOR ORBITAL ARC ALLOTMENT OPTIMIZATION
Charles H. Reilly Jul. 1987 23 p
(Grant NAG3-159)
(NASA-CR-181150; NAS 1.26:181150; TR-718688-5) Avail: NTIS HC A02/MF A01 CSCL 22A

A mixed integer programming formulation of a satellite system synthesis problem if presented, which is referred to as the arc allotment problem (AAP). Each satellite administration is to be allotted a weighted-length segment of the geostationary orbital arc within which its satellites may be positioned at any longitudes. The objective function maximizes the length of the unweighted arc segment allotted to every administration, subject to single-entry co-channel interference restrictions and constraints imposed by the visible arc for each administration. Useful relationships between special cases of AAP and another satellite synthesis problem are established. Solutions to two example problems are presented.
Author

N87-25361# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
FLIGHT MAINTENANCE IN THE VICINITY OF A LIBRATION CENTER AND THE ONE IMPULSE TRANSFER TRAJECTORY TO THE LIMITED ORBIT IN THIS REGION
P. E. Eliasberg, T. A. Timokhava, and M. N. Boyarski *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 55-64 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25362# Barcelona Univ. (Spain). Dept. de Matematica Aplicada i Analisi.
STATIONKEEPING OF A QUASIPERIODIC HALO ORBIT USING INVARIANT MANIFOLDS
C. Simo, G. Gomez, J. Llibre, and R. Martinez (Universidad Autonoma de Barcelona, Bellaterra, Spain) *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 65-70 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25363# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
OPERATIONAL HALO ORBIT MAINTENANCE TECHNIQUE FOR SOHO
J. RodriguezCanabal *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 71-78 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25364# British Aerospace Aircraft Group, Bristol (England). Space and Communications Div.
LOW THRUST NAVIGATION FOR A COMET-NUCLEUS SAMPLE-RETURN MISSION
M. Noton, S. V. Salehi, and C. A. Elliott *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 81-88 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25365# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
GRAVITY ASSIST ORBITS
Miguel BelloMora and M. Friedhelm Hechler *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 89-96 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25366# Hatfield Polytechnic (England). Numerical Optimization Center.
TO BUS AND BACK
L. C. W. Dixon and Zohair A. Maany *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 97-102 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25367# Elektronik-System G.m.b.H., Munich (West Germany).
A TRAJECTORY OPTIMIZATION PROGRAM FOR SPACECRAFT NAVIGATION
Hanfried Schlingloff *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 103-108 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25372# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
OPTIMIZATION OF WORST CASE PERIGEE RAISING STRATEGY
M. J. Smalley and D. A. Young *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 149-155 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25374# Tokyo Univ. (Japan).
ORBIT DETERMINATION OF SAKIGAKE AND SUISEI ENCOUNTERING HALLEY'S COMET
T. Nishimura, T. Takano, T. Yamada, T. Kato, T. Jano, T. Wakaki, T. Mikami, A. Ushikoshi, and N. Mizutani *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 167-172 Prepared in cooperation with Fujitsu Ltd.,Tokyo (Japan). (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25376# European Space Agency, Paris (France).
COMET HALLEY ORBIT DETERMINATION BY MEANS OF THE PATHFINDER DATA: METHODS USED AND RESULTS OBTAINED
P. deBroeck, Friedhelm Hechler, Paul Kristiansen, and A. Sukhanov (Academy of Sciences, USSR, Moscow) *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 181-189 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25378# Deutsches Geodaetisches Forschungsinst., Munich (West Germany).
SURVEY ON STATUS AND PROSPECT OF EARTH GRAVITY MODELS FOR PRECISE ORBIT DETERMINATION IN CONNECTION WITH GEODYNAMIC APPLICATIONS
Christoph Reigber *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 201-206 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25379# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
PRECISE ORBIT DETERMINATION AT ESOC: EXPERIENCE, RESULTS AND IMPLICATIONS FOR FUTURE ESA MISSIONS
John M. Dow and Rolf-Ernst Muench *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 207-212 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25382# Centre National d'Etudes Spatiales, Toulouse (France).
PRECISE ORBIT DETERMINATION WITH THE DOPPLER ORBITOGRAPHY AND RADIO POSITIONING INTEGRATED BY SATELLITE (DORIS) SYSTEM AND THE ASSOCIATED ZEALOUS FOR ORBIT OBSERVATION METHODS (ZOOM) SOFTWARE
Y. Labrune, Francois Nouel, and C. Jayles *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 227-231 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25385# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. of Astronomical and Physical Geodesy.
ON PRECISE ORBIT DETERMINATION OF NAVSTAR/GLOBAL POSITIONING SYSTEM (GPS) SATELLITES AND A RELATED EUROPEAN TRACKING NETWORK
H. Landau and Guenter W. Hein *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 247-254 Revised (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25396# Technische Hochschule, Darmstadt (West Germany).
FAST NUMERICAL INTEGRATION OF INTERPLANETARY ORBITS
Frank Debatin, A. Tilgner, and Friedhelm Hechler *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 329-333 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25397# Zaragoza Univ. (Spain). Dept. Fisica de la Tierra y del Cosmos.
THE USE OF EULER PARAMETERS IN THE ROTATION OF A SATELLITE NEAR L4
A. Abad, M. Arribas, and A. Elipe *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 335-338 (For primary document see N87-25354 19-18)
(Contracts DGA-CB4/85; CAICYT-Proj-779-84)
Copyright Avail: NTIS HC A22/MF A01

N87-25398# Rome Univ. (Italy). Dipt. Aerospaziale.
LONG-TERM ORBIT PREDICTION OF HIGH-ALTITUDE EARTH SATELLITES
Carlo Ulivieri and A. Agneni *In* ESA Proceedings of the Second Intenational Symposium on Spacecraft Flight Dynamics Dec. 1986 p 339-344 Sponsored by CNR (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25399# National Bureau of Standards, Gaithersburg, Md.
TIME TRANSFORMATION AND LINEARIZATION ON RADIAL INTERMEDIARIES IN THE ZONAL EARTH ARTIFICIAL SATELLITE THEORY
S. Ferrer and M. L. Sein-Echaluce (Zaragoza Univ., Spain) *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 345-348 Sponsored by Diputacion General de Aragon, and the Spanish Asesora Interministerial Cientifica y Tecnica (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25400# Academia Sinica, Beijing (China). Space Science and Technology Center.
THE NEWTON-RAPHSON METHOD IN ORBIT DETERMINATION
Huai-bao Gao, Ker-zhuong Luo, and Wen-ling Huang *In* ESA Proceedings of the Second International Symposium on the Spacecraft Flight Dynamics Dec. 1986 p 349-354 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25401# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ONBOARD ORBIT DETERMINATION USING DATA RELAY SATELLITES
Van-Nhan Nguyen *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 355-360 Sponsored by CNES (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25402# Polytechnical Univ. of Madrid (Spain). Dept. Mathematica Aplicada a la Tecnica.
A NEW SET OF CANONICAL VARIABLES FOR ORBIT CALCULATION
Jose M. Ferrandiz *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 361-364 (For primary document see N87-25354 19-18)
(Grant CB2/85)
Copyright Avail: NTIS HC A22/MF A01

N87-25405# Politecnico di Torino (Italy). Dipt. di Automatica e Informatica.
ON-GROUND ATTITUDE RECONSTITUTION OF THE HIPPARCOS SATELLITE
E. Canuto and F. Donati *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 379-384 Sponsored by CNR (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25410# Rockwell International Corp., Houston, Tex.
MANNED SPACEFLIGHT TRAJECTORY OPERATIONS: THE DIFFERENCES
R. K. Osburn *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 431-442 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25413# Centre National d'Etudes Spatiales, Toulouse (France).
CARTEL: A METHOD TO CALIBRATE S-BAND RANGES WITH GEOSTATIONARY SATELLITES
A. Guitart, R. Mesnard, and F. Nouel *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 467-471 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25415# National Space Development Agency, Ibaraki (Japan).
NATIONAL SPACE DEVELOPMENT AGENCY'S (NASDA) OPERATIONAL ORBIT COMPUTATION SYSTEM FOR LATE 80'S
A. Yamamoto, M. Sawabe, Y. Fujita, T. Shimizu, Y. Katsumata, and T. Morimoto (Fujitsu Ltd., Tokyo, Japan) *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 481-486 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

N87-25342# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
CRITICAL POINT FACILITY (CPF) PHASE 1-B Final Report
Paris, France ESA Feb. 1986 354 p Prepared in cooperation with National Aerospace Lab., Amsterdam, Netherlands, OIP Optics N.V., Gent, Belgium, Space Research Organization Netherlands, Utrecht, and Amsterdam Univ., Netherlands
(Contract ESTEC-6339/85-NL-PR)
(FOK-TR-R-85-120; ESA-CR(P)-2315; ETN-87-99871) Copyright Avail: NTIS HC A16/MF A01

A Spacelab critical point facility concept is described. A high degree of modularity and flexibility is achieved by a drawer concept. Within each experiment-drawer, the user may choose between different options for the optical lay-out. The experiment drawers are serviced by a common electronics drawer. ESA

N87-25343# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
SAFETY TESTING OF REMOTELY LAUNCHED MISSILES Final Report
16 Mar. 1987 66 p
(AD-A180028; ITOP-5-2-620) Avail: NTIS HC A04/MF A01 CSCL 16A

This ITOP describes procedures for safety testing and evaluation of remotely launched missile systems. The ITOP addresses safety during system testing, storage, transport, handling, maintenance and firing. Emphasis is on serious personnel explosive hazards during non-combat deployment. Description of tests and evaluation to be conducted for system safety releases is provided. GRA

N87-25344* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WEIGHTLESSNESS SIMULATION SYSTEM AND PROCESS Patent
Hubert C. Vykukal, inventor (to NASA) 7 Jul. 1987 8 p Filed 29 Oct. 1986 Supersedes N87-15253 (25 - 7, p 873)
(NASA-Case-ARC-11646-1; US-Patent-4,678,438;
US-Patent-Appl-SN-924398; US-Patent-Class-434-34) Avail: US Patent and Trademark Office CSCL 14B

A weightlessness simulator has a chamber and a suit in the chamber. O-rings and valves hermetically seal the chamber. A vacuum pump connected to the chamber establishes a pressure in the chamber less than atmospheric pressure. A water supply tank and water supply line supply a body of water to the chamber as a result of partial vacuum created in the chamber. In use, an astronaut enters the pressure suit through a port, which remains open to ambient atmosphere, thus supplying air to the astronaut during use. The pressure less than atmospheric pressure in the chamber is chosen so that the pressure differential from the inside to the outside of the suit corresponds to the pressure differential with the suit in outer space.

Official Gazette of the U.S. Patent and Trademark Office

N87-25345# General Accounting Office, Washington, D. C. National Security and International Affairs Div.
SPACE SHUTTLE: ISSUES ASSOCIATED WITH THE VANDENBERG LAUNCH SITE
Oct. 1986 19 p
(PB87-176830; GAO/NSIAD-87-32BR; B-225026) Avail: NTIS HC A02/MF A01 CSCL 22D

Topics addressed include: Vanderberg Launch Site (VLS) cost estimates and technical issues; manned space flight from VLS; replacement orbiter; Senior Interagency Group for Space; composition of the Shuttle-related Interagency and Working Groups; and VLS funding history. GRA

N87-25412# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
REVIEW OF ESA TRACKING FACILITIES AND THEIR CONTRIBUTION TO THE ORBIT DETERMINATION
S. Pallaschke, M. Schaefer, and O. Mikkelsen (Computer Resources International A/S, Denmark) *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 457-465 (For primary document see N87-25354 19-18) Copyright Avail: NTIS HC A22/MF A01

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

No abstracts in this category.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N87-25346# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
TENDENCIES IN THE DEVELOPMENT OF SPACE TRANSPORTATION SYSTEMS [ENTWICKLUNGSTENDENZEN BEI RAUMTRANSPORTERN]
E. Hoegenauer and D. Davidts 1986 26 p In GERMAN Presented at the Fusions-Energie-Forum e.V., Rastatt, West Germany, 18 Oct. 1986
(MBB-UR-911/86; ETN-87-99944) Avail: Issuing Activity

Technical aspects and their implications in the development of space transportation systems are discussed. The tendency from throw-away rockets via partially reusable towards completely reusable transporters is recognizable. The capacity of all available systems is needed for the transportation of the increasing number of payloads till the end of the nineties. A prognosis of the global European transportation costs up to the year 2020 shows an explosive increase, jeopardizing further developments. The tasks of the space glider Hermes are given. The concept of the two-stage space transportation system SAENGER is proposed. The propulsion technology development required to cover a broad Mach number range is discussed. ESA

N87-25347*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GET AWAY SPECIAL (GAS) KENNEDY SPACE CENTER (KSC) USER HANDBOOK
Nov. 1986 26 p
(NASA-TM-89379; NAS 1.15:89379) Avail: NTIS HC A03/MF A01 CSCL 22B

Information is provided for originators of Get Away Special Space Shuttle payloads. The information covers the following: pre-arrival preparations, shipping of payload and ground support equipment, travel, arrival at Kennedy Space Center, what to expect, facilities, viewing the launch, press briefings, gas field operations process, public tours, and do's and don'ts. J.P.B.

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

N87-25348* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD AND APPARATUS FOR TELEMETRY ADAPTIVE BANDWIDTH COMPRESSION Patent
Olin L. Graham 21 Jul. 1987 11 p Filed 13 Sep. 1985 Supersedes N86-20466 (24 - 11, p 1731)
(NASA-Case-MSC-20821-1; US-Patent-4,682,225; US-Patent-Appl-SN-775990; US-Patent-Class-358-133; US-Patent-Class-358-105; US-Patent-Class-358-138) Avail: US Patent and Trademark Office CSCL 09F

Methods and apparatus are provided for automatic and/or manual adaptive bandwidth compression of telemetry. An adaptive sampler samples a video signal from a scanning sensor and generates a sequence of sampled fields. Each field and range rate information from the sensor are hence sequentially transmitted to and stored in a multiple and adaptive field storage means. The field storage means then, in response to an automatic or manual control signal, transfers the stored sampled field signals to a video monitor in a form for sequential or simultaneous display of a desired number of stored signal fields. The sampling ratio of the adaptive sample, the relative proportion of available communication bandwidth allocated respectively to transmitted data and video information, and the number of fields simultaneously displayed are manually or automatically selectively adjustable in functional relationship to each other and detected range rate. In one embodiment, when relatively little or no scene motion is detected, the control signal maximizes sampling ratio and causes simultaneous display of all stored fields, thus maximizing resolution and bandwidth available for data transmission. When increased scene motion is detected, the control signal is adjusted accordingly to cause display of fewer fields. If greater resolution is desired, the control signal is adjusted to increase the sampling ratio.
Official Gazette of the U.S. Patent and Trademark Office

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N87-25349*# Astro Aerospace Corp., Carpinteria, Calif.
DESIGN, DEVELOPMENT AND FABRICATION OF A DEPLOYABLE/RETRACTABLE TRUSS BEAM MODEL FOR LARGE SPACE STRUCTURES APPLICATION Final Report
Louis R. Adams Jun. 1987 64 p
(Contract NAS1-18013)
(NASA-CR-178287; NAS 1.26:178287; AAC-TN-1150-Rev-A)
Avail: NTIS HC A04/MF A01 CSCL 22B

The design requirements for a truss beam model are reviewed. The concept behind the beam is described. Pertinent analysis and studies concerning beam definition, deployment loading, joint compliance, etc. are given. Design, fabrication and assembly procedures are discussed. Author

N87-25350# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
SOME PROBLEMS IN THE CONTROL OF LARGE SPACE STRUCTURES Final Report, 1 Jan. - 30 Jun. 1986
Leonard Meirovitch 16 Dec. 1986 58 p
(Grant AF-AFOSR-0017-83)
(AD-A179989; AFOSR-87-0426TR) Avail: NTIS HC A04/MF A01 CSCL 22B

Work during this period has been concerned with control of traveling waves in structures and developments in the control of distributed structures. In modal control of traveling waves, the question can be raised whether actuator forces at points removed from a given disturbance can begin working before the arrival of the disturbance. This question is prompted by the fact that modal forces begin acting at $t = 0$. However, the modal forces are not the actual forces, although the actual actuator forces are linear combinations of the modal forces. It is demonstrated that these combinations are such that the control forces tend to concentrate in the immediate vicinity of the disturbance and tend to vanish at points removed from the disturbance. One problem in the control of distributed structures is that control implementation must be carried out by discrete actuators. In using direct feedback, whereby the sensors and actuators are collocated and the actuator input depends only on the sensor output at the same location, asymptotic stability can be virtually guaranteed. Problems arise when one desires to place the closed-loop poles. It appears that there is some incompatibility between direct feedback and pole placement. In particular, in placing the poles for a number of controlled modes, the possibility of destabilizing uncontrolled modes exists. GRA

N87-25351# Army Military Personnel Center, Alexandria, Va.
THERMAL AND DYNAMICAL EFFECTS ON ELECTRODYNAMIC SPACE TETHERS Final Report
John S. Prall, Jr. 8 May 1987 139 p
(AD-A180276) Avail: NTIS HC A07/MF A01 CSCL 10A

Electrodynamic tethers are essentially long conducting wires which, when deployed from an orbiting satellite, can generate power by converting orbital mechanical energy into electrical energy for use on the satellite. An analytical and numerical analysis was carried out on the operation of an electrodynamic tether system used for power generation and/or thrusting in a space environment. Three problems were examined. First, the efficiency of an uninsulated tether of prescribed design, as determined by the magnitude of current leakage along its length due to positive ion capture and secondary electron emissions, was compared to that of a perfectly insulated tether of identical design. Second, the effects on system efficiency of variations in the design parameters of the tether and the orbit in which it operates were examined by means of a numerical analysis of the thermal balance of the system. Third, the effects which the mode of operation of the tether has on the classical elements of the orbit in which it operates were examined through a numerical analysis. GRA

N87-25352# Army Military Personnel Center, Alexandria, Va.
SUBOPTIMAL CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES EXPERIENCING ROTATIONAL DYNAMICS NONLINEARITIES Final Report
George D. Mitroka 8 May 1987 102 p
(AD-A180606) Avail: NTIS HC A06/MF A01 CSCL 22B

Developed is a method to determine a suboptimal smooth trajectory for large flexible space structures during rotational slewing maneuvers. It consists of minimizing the quadratic integral of the corresponding second time derivative of the generalized coordinate subject to specified boundary conditions. A parametric study examined the consequences of varying the number of design parameters and the number of specified boundary conditions. Study results include: (1) Additional degrees of freedom reduce the curvature of the trajectory, reduce the peak maneuver angle rate and only slightly increase the peak rigid-body torques on the structure during slewing maneuvers; (2) Additional boundary conditions result in smoother transitions at the end points between targeting maneuvers and increase the peak maneuver angle rate and rigid-body torques by a larger percentage than do additional design parameters. Next, planar dynamics equations of motion for a uniform, inextensible, cantilevered beam capable of small transverse deformations and which retain the rotational (centrifugal) nonlinearities are derived via Newton's Laws, nondimensionalized and cast into a form suitable for numerical integration. GRA

N87-25353* National Aeronautics and Space Administration, Washington, D.C.
SPACE STATION SYSTEMS: A BIBLIOGRAPHY WITH INDEXES
May 1987 221 p
(NASA-SP-7056(04); NAS 1.21:7056(04)) Avail: NTIS HC A10 CSCL 22B

This bibliography lists 832 reports, articles and other documents introduced into the NASA scientific and technical information system between July 1, 1986 and December 31, 1986. The coverage includes documents that define major systems and subsystems, servicing and support requirements, procedures and operations, and missions for the current and future space station.
Author

N87-25354# European Space Agency, Paris (France).
PROCEEDINGS OF THE SECOND INTERNATIONAL SYMPOSIUM ON SPACECRAFT FLIGHT DYNAMICS
T. D. Guyenne, comp. and J. J. Hunt, comp. Dec. 1986 501 p Symposium held in Darmstadt, West Germany, 20-23 Oct. 1986
(ESA-SP-255; ISSN-079-6566; ETN-87-99862) Copyright Avail: NTIS HC A22/MF A01

Flexible spacecraft dynamics; halo orbits; interplanetary trajectories; geostationary satellites; precise orbit determination; onboard systems and spacecraft hardware; orbital mechanics; spinning spacecraft; satellite tracking; and ground systems were discussed. For individual titles, see N87-25355 through N87-25416.

N87-25355*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYNAMICS DURING THRUST MANEUVERS OF FLEXIBLE SPINNING SATELLITES WITH AXIAL AND RADIAL BOOMS
R. W. Longman (Columbia Univ., New York.) and J. V. Fedor *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 13-18 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01 CSCL 22B

The dynamic response to operational maneuvers of spinning symmetric spacecraft with radial and axial booms was analyzed as part of the prelaunch dynamic analysis of the ISEE-3 spacecraft placed in a halo orbit around an Earth-Sun libration point, and later renamed ICE when it was directed to fly-by comet Giacobini-Zinner. The results presented use simple spacecraft models, and frequently give predictions that are good and easily obtained when the results from using a general purpose multibody dynamics program were very time consuming to obtain. Deployment of radial booms, spin-up after partial deployment, stationkeeping, and trajectory changes are analyzed. The latter two can involve both axial thrusting and pulsed radial thrusting once per revolution.
ESA

N87-25356# Indian Inst. of Science, Bangalore.
DYNAMICS OF AN ACTIVELY CONTROLLED FLEXIBLE EARTH OBSERVATION SATELLITE
S. K. Shrivastava, P. S. Goel (Indian Space Research Organization, Bangalore.), M. SeetharamaBhat, and A. G. Sreenatha *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 19-24 Sponsored by the Indian Space Research Organization (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

Attitude and flexural dynamics of an Earth-oriented satellite with a rigid main body and two large rectangular flexible Sun-tracking solar panels are presented. It is controlled using three reaction wheels operating on PWPFM logic with a modified Schmitt trigger and attitude sensors. The governing equations being highly nonlinear and coupled, numerical solution is resorted to. The system parameters corresponding to those of the Indian Remote Sensing satellite are used for the simulation. After studying the system performance, a modified controller with a 12th order Kalman filter and observer introduced to reduce the effects of the sensor noise and to improve the system characteristics is considered. The effects of sampling and quantization of the sensor output are also studied.
ESA

N87-25357# British Columbia Univ., Vancouver. Dept. of Mechanical Engineering.
A FORMULATION FOR STUDYING STEADY STATE/TRANSIENT DYNAMICS OF A LARGE CLASS OF SPACECRAFT AND ITS APPLICATION
A. M. Ibrahim and V. J. Modi *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 25-30 (For primary document see N87-25354 19-18)
(Grant NSERC-G-1547)
Copyright Avail: NTIS HC A22/MF A01

A formulation for studying dynamics of a system, consisting of n connected flexible deployable members forming a topological tree or a closed configuration, is presented. The mathematical description of the system can be a combination of discrete and distributed coordinates. Joints, elastic and dissipative, permit relative rotation and translation between bodies. The elastic deformations can be discretized using admissible functions, finite elements, or lumped mass method. Rotations of the members, as well as of the entire system, can be described using a set of orientation angles, Euler parameters or Rodrigues vectors. The formulation accounts for: the presence of momentum or reaction wheels; thrusters distributed over the flexible and rigid portions; and any prescribed forms of energy dissipation mechanisms. The formulation is valid for orbiting as well as ground based and marine systems. Application of the formulation is illustrated through an example in spacecraft dynamics.
ESA

N87-25358# Rome Univ. (Italy). Dept. of Informatica e Sistemistica.
SAMPLED NONLINEAR CONTROL FOR LARGE ANGLE MANEUVERS OF FLEXIBLE SPACECRAFT
S. Monaco, D. N. Cyrot, and S. Stornelli (Telespazio, S.p.A., Rome, Italy) *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 31-38 Sponsored by Telespazio S.P.A. (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

A method for the design of attitude control systems for flexible spacecraft is presented. The design procedure employs input-output linearization and stabilization techniques; computation of the sampled-data control laws, and compensation techniques are applied to reduce the influence of the flexible part on the control system design. An idealized test vehicle subject to a variety of control laws was simulated. The improvements obtained by using a sampled-data scheme with an extended control are evident from the results of the simulations.
ESA

N87-25359# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE EFFECTS OF STRUCTURAL PERTURBATIONS ON DECOUPLED CONTROL
R. A. Calico and R. L. Hinrichsen *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 39-45 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

The effects of structural perturbations on the decoupled control of a large space structure are considered. The structure is controlled through multiple subcontrollers, each of which controls a subset of the spacecraft modes. The stability of the entire system is assured by constraining the gain matrices for the individual subcontrollers such that the stability of the system is not affected by the coupling between the subcontrollers. Structural perturbations reintroduce coupling among the subcontrollers, which may lead to instability. This coupling is shown to be related to changes in the row and column spaces of the individual control and observation matrices, respectively. A simple test for the determination of the effects of these changes is presented. The use of the test is

evaluated on the control of the CSDL I spacecraft using three subcontrollers. ESA

N87-25360# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Mechanik II.

ACTIVE VIBRATION DAMPING OF FLEXIBLE STRUCTURES USING THE TRAVELING WAVE APPROACH

P. Hagedorn and J. T. Schmidt *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 47-52 Sponsored by the Stiftung Volkswagenwerk (For primary document see N87-25354 19-18)

Copyright Avail: NTIS HC A22/MF A01

A traveling wave approach for the vibration control of networks of slender flexible structural components is presented. The performance of the resulting controller is evaluated and compared with a classical modal controller using a simple model of a prestressed string. Both controllers are tested in numerical simulations. The traveling wave approach is demonstrated to have significant advantages. In particular, it is insensitive to a change in system boundary conditions. ESA

N87-25361# Academy of Sciences (USSR), Moscow. Inst. of Space Research.

FLIGHT MAINTENANCE IN THE VICINITY OF A LIBRATION CENTER AND THE ONE IMPULSE TRANSFER TRAJECTORY TO THE LIMITED ORBIT IN THIS REGION **c13**

P. E. Eliasberg, T. A. Timokhava, and M. N. Boyarski *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 55-64 (For primary document see N87-25354 19-18)

Copyright Avail: NTIS HC A22/MF A01

The problem of spacecraft (SC) motion control aimed at long-term keeping of the SC in the vicinity of one of collinear centers L1 or L2 in the restricted elliptic three-body problem is considered. The osculating parameters method is used. The equations of SC motion are obtained in these parameters. These equations were employed to find the necessary integral condition for orbit to be limited. The method of search for limited orbit under this condition was constructed as well as method of calculation of correction impulses necessary for a long-term maintenance of the limited orbit. The method of search for a one-impulse transfer trajectory between Earth satellite orbit and about libration center is also described. ESA

N87-25362# Barcelona Univ. (Spain). Dept. de Matematica Aplicada i Analisi.

STATIONKEEPING OF A QUASIPERIODIC HALO ORBIT USING INVARIANT MANIFOLDS **c13**

C. Simo, G. Gomez, J. Llibre, and R. Martinez (Universidad Autonoma de Barcelona, Bellaterra, Spain) *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 65-70 (For primary document see N87-25354 19-18)

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Stationkeeping of quasiperiodic orbits near a periodic halo orbit of the Earth+Moon-Sun system is analyzed. The full solar system is considered as a perturbation of the restricted three body problem. In the full solar system the periodic orbits are lost but the system still has quasi periodic solutions relatively close to the previous halo orbits. They are approximately obtained analytically and refined numerically. These orbits can be taken as nominal orbits for halo missions. They inherit the unstable character of the halo orbits. Although they are no longer periodic their invariant manifolds, which are approximated by analytical and numerical solutions of the variational equations, can be introduced. Simple geometrical considerations help to develop a very cheap stationkeeping algorithm. ESA

N87-25363# European Space Agency. European Space Operations Center, Darmstadt (West Germany).

OPERATIONAL HALO ORBIT MAINTENANCE TECHNIQUE FOR SOHO **c13**

J. RodriguezCanabal *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 71-78 (For primary document see N87-25354 19-18)

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Orbits in the proximity of the L1 and L2 libration points of systems similar to the ones of the Earth-Sun or the one of the Earth-Moon are discussed. The method of orbit maintenance proposed in the feasibility study of the SOHO mission is presented. This method is based on the computation of a reference orbit by solving a simple constrained minimization problem. This orbit has a very small residual acceleration and can be used as the reference orbit for a control of the spacecraft by linear-quadratic control theory. This type of control minimizes the maneuvers used for orbit maintenance and stabilizes the operational orbit as well. The simplicity, robustness, and flexibility of the method make it very well suited for direct appliction in the operational flight dynamics software for the control of the SOHO mission. ESA

N87-25364# British Aerospace Aircraft Group, Bristol (England). Space and Communications Div.

LOW THRUST NAVIGATION FOR A COMET-NUCLEUS SAMPLE-RETURN MISSION **c13**

M. Noton, S. V. Salehi, and C. A. Elliott *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 81-88 (For primary document see N87-25354 19-18)

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Navigation (orbit determination and guidance) on the heliocentric transfer trajectories, and approach for rendezvous with a comet are discussed. Estimation of the gravitation constant in a coast arc near the comet, and maneuvers within the irregular gravitational field of a comet are considered. ESA

N87-25365# European Space Agency. European Space Operations Center, Darmstadt (West Germany).

GRAVITY ASSIST ORBITS **c13**

Miguel BelloMora and M. Friedhelm Hechler *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 89-96 (For primary document see N87-25354 19-18)

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The calculation of three different types of gravity assist orbits is discussed. The common approach is the formulation of the problem as constrained parameter optimization. A lunar swingby to rotate the orbit plane of cluster after an ARIANE 4 double launch with SOHO; the GIOTTO post Halley Earth flyby to comet Grigg-Skjellerup; and an energy raising Earth gravity assist orbit for the Comet Nucleus Sample Return Mission are discussed. The proper choice of variables and constraints on the optimization, and the availability of good initial solutions are necessary for convergence of the method. The latter are obtained by heuristic considerations of celestial mechanics or by solving approximate problems (e.g., patched conics, Lambert problem). ESA

N87-25366# Hatfield Polytechnic (England). Numerical Optimization Center.

TO BUS AND BACK **c13**

L. C. W. Dixon and Zohair A. Maany *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 97-102 (For primary document see N87-25354 19-18)

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Software for the computation of optimal satellite trajectories was used to investigate the problem of rendezvous with comet Bus and subsequently returning to Earth. The investigation was carried out for a number of different power levels. On a number of these the optimization algorithm produced a solution in which the sign of the switching function was incorrect over all or part of the trajectory. Investigations indicate that this implies that an incorrect pattern of thrust and coast arcs was specified, and the method adopted for using this information to determine the correct pattern is described. ESA

N87-25367# Elektronik-System G.m.b.H., Munich (West Germany).
A TRAJECTORY OPTIMIZATION PROGRAM FOR SPACECRAFT NAVIGATION **c13**
Hanfried Schlingloff *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 103-108 (For primary document see N87-25354 19-18)
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The calculation program system SPACENAV, an optimization scheme for three-dimensional multiple-burn maneuver strategies of spacecraft is introduced. Example trajectories are shown. Examples cover the flight planning of an interplanetary solar-electric propulsion multi-asteroid-rendezvous and flyby mission. ESA

N87-25368# Centre National d'Etudes Spatiales, Toulouse (France).
TOOLS FOR INTERPLANETARY MISSION ANALYSIS **c12**
F. Bonneau, J. Bernard, and J. Foliard *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 109-113 (For primary document see N87-25354 19-18)
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Elementary tools for interplanetary mission analysis: trajectory computation, trajectory optimization, trajectory description for any multiple flyby trajectory (including swing-by) are described. Most of the programs are implemented on personal computers. Already applied to interplanetary projects (Vesta, Ariane 5, Delta Vega) they give good and quick results for mission analysis in phase 0 or phase A. ESA

N87-25369# National Space Development Agency, Tokyo (Japan). Satellite Program Dept.
STATE ESTIMATION ALGORITHM CONSIDERING ATTITUDE MOTION FOR APOGEE MOTOR BURNING OF GEOSTATIONARY SATELLITE
S. Ono *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 117-133 (For primary document see N87-25354 19-18)
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An algorithm of state estimation with attitude motion for the powered flight phase by apogee boost motor of a geostationary satellite is presented. The measured Doppler data oscillate with a spin period for the satellite equipped with an offset antenna, or fluctuate due to the occurrence of apogee motor firing error. A technique for specification of the error resource against the orbit injection error is outlined. The estimation results by the simplified filter with attitude motion are discussed. The technique is especially suited to real time estimation during maneuvers with a liquid propellant motor. ESA

N87-25370# Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse (France).
APPLICATION OF DYNAMIC PROGRAMMING TO STATION ACQUISITION OF A GEOSTATIONARY SATELLITE
Philippe Desroches and Didier ElBaz *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 135-139 (For primary document see N87-25354 19-18)
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Multiple burn apogee maneuver strategies for geostationary satellites are discussed. A method based on dynamic programming, suited to the optimization of orbit corrections, was designed to cope with the problem of dimensionality proper to dynamic programming. First a simplified orbit correction problem which corresponds to impulsive approximation is solved using a backward dynamic programming procedure. This solution is used to initialize an iterative procedure which looks for an optimum of the low thrust case. The elementary process of the iterative procedure is a backward dynamic programming process. This method is used to solve a highly constrained problem with limitation on the total time for station acquisition, time interval between apogee maneuvers, visibility to ground stations, and location of the spacecraft in the orbit with respect to the Sun. ESA

N87-25371# National Space Development Agency, Tokyo (Japan). Tsukuba Space Center.
STATIONKEEPING METHODS FOR TWO BROADCASTING SATELLITES IN THE SAME GEOSTATIONARY POSITION
A. Tanaka, Mirota, H. Mineno, and M. Miyashita (Fujitsu Ltd., Tokyo, Japan) *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 141-147 (For primary document see N87-25354 19-18)
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Three station keeping methods to keep twin geostationary satellites avoiding collision and mutual occultations within a given longitudinal tolerance are introduced: longitude separation method synchronized method, and eccentricity separation method. Taking into account orbit determination errors, maneuver errors and so on, the operational station keeping tolerance and maneuver execution intervals are investigated numerically for the Japanese twin broadcasting satellites, BS-2a and BS-2b. An operation result of the synchronized method applied for BS-2 is introduced. This method is ascertained to be useful for sharing the geostationary ring more efficiently. ESA

N87-25372# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
OPTIMIZATION OF WORST CASE PERIGEE RAISING STRATEGY **c13**
M. J. Smalley and D. A. Young *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 149-155 (For primary document see N87-25354 19-18)
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A method of optimizing the apogee burns to maximize the worst-case beginning of life mass for a geosynchronous satellite is presented. Optimizing the worst-case rather than the nominal transfer strategy results in a reduction in the propellant mass required for the maneuver. A computer program written to implement the algorithm is described and the results of two case studies are presented. One of these case studies employs a single apogee engine burn with the thrust vector following a slew about a single spacecraft axis. The second employs a multiburn apogee engine maneuver with an inertially fixed thrust vector. Both cases show significant reductions in the propellant required for the 99th percentile case. ESA

N87-25373# National Space Development Agency, Tokyo (Japan). Tsukuba Space Center.
EFFICIENT ESTIMATION SCHEME FOR SPIN-AXIS ATTITUDE DRIFT IN THE KEEPING PHASE
Kazuya Kaku and M. Horii *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 157-164 (For primary document see N87-25354 19-18)
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An estimation scheme for the attitude determination of spin-stabilized geostationary satellites in the keeping phase was derived, based on an attitude drift model. In this model, parameters (i.e., attitudes of epochs, attitude drift rate and direction, and biases of measurements) are estimated by the least squares method from the measurements of nadir angles. Results of the verification of the scheme by the telemetry data of the satellite on orbit are explained. ESA

N87-25374# Tokyo Univ. (Japan).
ORBIT DETERMINATION OF SAKIGAKE AND SUISEI ENCOUNTERING HALLEY'S COMET **c13**
T. Nishimura, T. Takano, T. Yamada, T. Kato, T. Jano, T. Wakaki, T. Mikami, A. Ushikoshi, and N. Mizutani *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 167-172 Prepared in cooperation with Fujitsu Ltd.,Tokyo (Japan). (For primary document see N87-25354 19-18)
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The orbit determination program used to track the Japanese Halley's comet flyby satellites is described. A square root filter form is adopted in addition to the normal-equation form as the

estimation formula, since filtering itself has numerical difficulty because of poor observability due to the long distance between the probe and the tracking station. The effect of general relativity is taken into account in the equation of motion as well as in the observation model. Tracking results are shown. ESA

N87-25375*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GIOTTO INTERPLANETARY ORBIT DETERMINATION
Trevor A. Morley, Friedhelm Hechler, Steen Jappe (European Space Agency. European Space Operations Center, Darmstadt, West Germany), Neil Mottinger, and R. Premkumar *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 173-180 (For primary document see N87-25354 19-18)
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Development, testing, and application of the Giotto orbit determination software are described. The final targetting for a close flyby of comet Halley is described. ESA

N87-25376# European Space Agency, Paris (France).
COMET HALLEY ORBIT DETERMINATION BY MEANS OF THE PATHFINDER DATA: METHODS USED AND RESULTS OBTAINED c13
P. deBroeck, Friedhelm Hechler, Paul Kristiansen, and A. Sukhanov (Academy of Sciences, USSR, Moscow) *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 181-189 (For primary document see N87-25354 19-18)
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Use of the pointing angle from the Soviet spacecraft Vega-1 and Vega-2 to the nucleus of the comet, derived from attitude and camera data collected onboard the two spacecraft, to determine comet orbit for Halley flyby by Giotto is described. Pathfinder results after Vega-1 and Vega-2 encounters are discussed. ESA

N87-25377*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORBITAL ACROBATICS IN THE SUN-EARTH-MOON SYSTEM
Robert W. Farquhar, D. W. Dunham, and S. C. Hsu (Computer Sciences Corp., Silver Spring, Md.) *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 191-198 (For primary document see N87-25354 19-18)
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Unconventional trajectory techniques for space missions in the Sun-Earth-Moon system, including libration-point orbits, gravity-assist maneuvers, and Earth-return trajectories are reviewed. The ISEE-3/ICE flight experience is used to illustrate the utility of libration-point orbits called halo-orbits. Five lunar gravity-assist maneuvers used by the ISEE-3/ICE spacecraft are discussed. The final lunar swingby sent the spacecraft into a heliocentric trajectory that will eventually intercept Comet Giacobini-Zinner. As an example of the Earth-return trajectory concept, a proposed mission that includes flybys of three comets and two asteroids is described. ESA

N87-25378# Deutsches Geodaetisches Forschungsinst., Munich (West Germany).
SURVEY ON STATUS AND PROSPECT OF EARTH GRAVITY MODELS FOR PRECISE ORBIT DETERMINATION IN CONNECTION WITH GEODYNAMIC APPLICATIONS c13
Christoph Reigber *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 201-206 (For primary document see N87-25354 19-18)
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Gravitational field model accuracy and usability for geodynamic mission applications are discussed. Problems with these models, in particular in connection with precision orbit determination are identified, and on-going activities for improved models are described. ESA

N87-25379# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
PRECISE ORBIT DETERMINATION AT ESOC: EXPERIENCE, RESULTS AND IMPLICATIONS FOR FUTURE ESA MISSIONS c13
John M. Dow and Rolf-Ernst Muench *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 207-212 (For primary document see N87-25354 19-18)
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A program to develop the capability of supporting ESA near-Earth missions that have stringent requirements on orbit accuracy is introduced. Activity is centered around a software system for orbit determination and covariance analysis which contains state-of-the-art models for a wide range of orbital perturbations and measurement types, and permits estimation and error analysis of geophysical and geodetic parameters in addition to the orbital states of the satellites. The implications for operational support of near-Earth ESA missions are discussed. Applications involving analysis of future mission requirements and processing of laser ranging and altimetry data are described. ESA

N87-25380# Technische Hogeschool, Delft (Netherlands). Faculty of Aerospace Engineering.
EUROPEAN LASER STATION POSITIONING FROM LAGEOS LASER RANGING
R. Noomen, B. A. C. Ambrosius, Karel F. Wakker, and H. J. D. Piersma *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 215-222 (For primary document see N87-25354 19-18)
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Results of the analyses of global full-rate laser ranging measurements of LAGEOS, acquired during the 1983/1984 MERIT campaign, and global quick-look LAGEOS data, obtained from January to July 1986 in the first WEGENERMEDLAS campaign are presented. Computation of precise LAGEOS orbits, modeling of surface forces acting on the satellite, and the determination of precise European laser station positions and interstation baselines are discussed. The analyses, primarily based on 1-week data arcs, show that the consistency of baselines computed from full-rate data is not different from that computed from quick-look data: the scatter in independently derived baseline solutions is 5 cm. The baselines between three collocating laser systems in Southern Italy, obtained from quick-look data in a 10-week data arc, agree to better than 2 cm with the surveyed values. The analyses disclose deficiencies of the dynamic model employed, especially mismodeling of solar eclipses by the Moon. It is shown that the orbit of LAGEOS was severely affected by a rare extremely lengthy solar eclipse lasting 70 min. ESA

N87-25381# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
COMPUTATION OF PRECISE STATION COORDINATES USING LASER RANGING c36
Hermann Hauck *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 223-226 (For primary document see N87-25354 19-18)
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High quality laser data obtained by European laser stations were evaluated by the short-arc and a 15-day long-arc technique, based on the processor program UTOPIA. The long-arc technique provided systematic patterns in the orbital residuals which lead to a mean observational error of + or - 6.8 cm, while the short-arc residuals look rather randomly distributed. Mean observational error is + or - 1.9 cm. Though completely different methods were applied, lengths of the baselines between the stations show good agreement. ESA

N87-25382# Centre National d'Etudes Spatiales, Toulouse (France).
PRECISE ORBIT DETERMINATION WITH THE DOPPLER ORBITOGRAPHY AND RADIO POSITIONING INTEGRATED BY SATELLITE (DORIS) SYSTEM AND THE ASSOCIATED ZEALOUS FOR ORBIT OBSERVATION METHODS (ZOOM) SOFTWARE c13
Y. Labrune, Francois Nouel, and C. Jayles *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 227-231 (For primary document see N87-25354 19-18)
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In support of radar altimetry for oceanographic missions by satellites, Doppler Orbitography and Radio-positioning Integrated by Satellite will provide measurements, by a spaceborne receiver, of the Doppler shift of radio signals transmitted from a ground network of a large number of orbit-devoted beacons. A software (Zealous for Orbit Observation Methods) system for orbit extrapolation, covariance analysis, and orbit determination, which is suitable for precise orbits was developed. User friendliness is achieved with screen oriented pre- and post-processors on a microcomputer. The whole system (hardware and software) is conceived for the TOPEX/POSEIDON mission, but it will be tested on the SPOT 2 platform. ESA

N87-25383*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NEAR-OPTIMAL STRATEGIES FOR SUB-DECIMETER SATELLITE TRACKING WITH GPS
Thomas P. Yunck, Sien-Chong Wu, and Jiun-tsong Wu *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 233-238 (For primary document see N87-25354 19-18)
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Decimeter tracking of low Earth orbiters using differential Global Positioning System (GPS) techniques is discussed. A precisely known global network of GPS ground receivers and a receiver aboard the user satellite are needed, and all techniques simultaneously estimate the user and GPS satellite orbits. Strategies include a purely geometric, a fully dynamic, and a hybrid strategy. The last combines dynamic GPS solutions with a geometric user solution. Two powerful extensions of the hybrid strategy show the most promise. The first uses an optimized synthesis of dynamics and geometry in the user solution, while the second uses a gravity adjustment method to exploit data from repeat ground tracks. These techniques promise to deliver subdecimeter accuracy down to the lowest satellite altitudes. ESA

N87-25384# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
AERODYNAMIC MODELLING OF SPACECRAFT FOR PRECISE ORBIT DETERMINATION
J. Stark *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 239-246 (For primary document see N87-25354 19-18)
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The sensitivity of orbit prediction to spacecraft aerodynamic forces is examined. By separating the molecular momentum flux due to impinging and reemitted molecules, it is demonstrated that lifting forces are very much more sensitive to the model adopted for gas-surface interactions than the drag force experienced by a vehicle traveling in low Earth orbit. An empirically based parametric model for gas/surface interactions is summarized and compared with thermal equilibrium and Schamberg models. The dominant effect of changing the interaction model is upon along track perturbations, at decametric level. Radial perturbations are noted at the deca and centimetric level. It is concluded that the only method available for reducing orbit determination residuals caused by aerodynamic forces is through additional experimental data of gas/surface interactions. ESA

N87-25385# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. of Astronomical and Physical Geodesy.
ON PRECISE ORBIT DETERMINATION OF NAVSTAR/GLOBAL POSITIONING SYSTEM (GPS) SATELLITES AND A RELATED EUROPEAN TRACKING NETWORK c13
H. Landau and Guenter W. Hein *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 247-254 Revised (For primary document see N87-25354 19-18)
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European tracking networks for the determination of the orbits of NAVSTAR satellites of the Global Positioning System were designed and simulation studies carried out. The effects of different error sources (unadjusted measurement and dynamic errors) on the orbit determination using single-difference phase and pseudo-range data at the proposed tracking stations are discussed. As a result of the feasibility study, the orbit can be determined at the 1 m level from each of the 4 considered networks in Europe allowing relative positioning in the 0.1 ppm range. ESA

N87-25386# Padua Univ. (Italy). Dipt. di Fisica.
AN ANALYSIS OF THE ORBITAL EVOLUTION OF LAGEOS FROM SEPTEMBER 1983 TO OCTOBER 1984
Allessandro Caporali, Franco Palutan, A. Cenci, M. Fermi, and R. M. Montereali *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 255-266 Sponsored by CNR Prepared in cooperation with Telespazio S. p. a., Rome, Italy (For primary document see N87-25354 19-18)
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The orbital dynamics of LAGEOS were analyzed using 14 months of laser ranging data processed by the GEODYN program. Results show that the model adopted, based on MERIT standards, has a repeatability ranging from 4 parts in 10 billion for the major semiaxis to 2 parts in 10 million for the mode. The residuals have random and systematic character. The frequencies of the systematic component are at least in part in the range of sensitivity of this analysis. The amplitudes cannot yet be estimated reliably. Uncertainties in the tide model cause the inclination and mode to contain larger systematics than the major semi axis and eccentricity. The Earth rotation rate contributes to systematics in the orbital parameters. Excellent agreement in amplitude and phase with the annual and Chandler constituents of polar motion independently derived by other groups is found. ESA

N87-25387# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
A NEW ANALYSIS OF SEASAT TRACKING DATA
Loukis G. Agrotis and John M. Dow *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 267-272 (For primary document see N87-25354 19-18)
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SEASAT orbit determination was used in validating orbit determination software for the ERS-1 mission. Reanalysis of the SEASAT laser and S-band tracking data is described. A laser station set was derived from the tracking data, while S-band station coordinates were obtained from combination solutions. The station solutions are compared with those from earlier analyses. The accuracy of the determined SEASAT orbits is assessed by comparing the S-band and laser solutions. The results of SEASAT orbit determination are also compared with those obtained from ERS-1 simulations and with ERS-1 accuracy requirements. ESA

N87-25388# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
AN IN-ORBIT DEMONSTRATION OF RECOVERY FROM FLAT SPIN FOR A MOMENTUM BIAS CONTROLLED COMMUNICATIONS SPACECRAFT: OTS
C. K. Leong, Nicholas F. Matthews, L. V. Holtz, and A. G. Bird (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of the Second International Symposium on Spacecraft

Flight Dynamics Dec. 1986 p 275-280 (For primary document see N87-25354 19-18)
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An attitude recovery technique for momentum biased satellites is presented. It applies to anomalies in which no significant external torques act on the satellite and hence the total angular momentum vector is conserved. The technique is based on a control law which minimizes the spin energy of the satellite body using the momentum wheel as the only actuator. It requires only reasonably accurate estimates of spacecraft inertias, which can be determined in orbit by a method described. By the inclusion of a first order predictor the control loop is shown to cope with significant delays in data acquisition and control implementation. The recovery technique is therefore suitable for implementation on-board or under ground control. An experiment demonstrates its effectiveness with ESA's communications satellite OTS. ESA

N87-25389# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
GIOTTO ATTITUDE AND ORBIT CONTROL MEASUREMENT SYSTEM (AOCMS) ON-BOARD SOFTWARE
E. Schutte, H. Meier, and E. Weih *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 281-287 (For primary document see N87-25354 19-18)
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The attitude and orbit control functions for the spin stabilized spacecraft Giotto were implemented in software in a microprocessor based control electronics. To keep software complexity low and to increase performance, tasks as sensor pulse dating, thruster control, spin segment clock, and spin reference pulse generation were allocated to peripheral hardware. Control and maneuver modes were implemented by software, easing the operation of the S/C from ground and allowing different degrees of autonomy to be selected. ESA

N87-25390# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
IUE: ONE YEAR WITH ONLY 2 GYROSCOPES
Oscar Ojanguren *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 289-293 (For primary document see N87-25354 19-18)
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The International Ultraviolet Explorer satellite lost gyroscope 3. Only two from the original set of six gyroscopes are left and three axis stabilization on gyroscopes alone was no longer possible. The on-board computer memory was reprogrammed with a control system that uses a Sun tracker, Fine Sun Sensor (FSS) to overcome the absence of the failed gyroscope. Three axis control was retrieved. Operational considerations on the two gyro FSS control system are presented. ESA

N87-25391# Technische Physische Dienst TNO-TH, Delft (Netherlands).
THE TECHNISCH PHYSISCHE DIENST (TPD) OFF-AXIS STAR TRACKER (TOAST) **c19**
H. Bokhove, P. P. Jonker, L. W. vanderKolk, and C. Roos *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 295-299 (For primary document see N87-25354 19-18)
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A star tracker based on a P8600 CCD detector with microprocessor control and star image processing is described. The detector is operated at a temperature less than minus 15 C using thermoelectric cooling. The accuracy goal is 1.5' for a field of view of 5.4 deg by 8.1 deg. The guide-star magnitude limit is 6.5, which gives a 99% probability to find at least 2 guide-stars on the detectors, permitting 3-axis attitude reconstruction. The camera mode permits visual interpretation of the starfield. In acquisition mode stars are searched for in regions specified by the on-board computer. In tracking mode the ultimate accuracy is obtained for a maximum of three stars. A functionally representative model was built; software implementation is in a final stage. ESA

N87-25392# Toshiba Research and Development Center, Kawasaki (Japan).
CCD FINE SUN SENSOR FOR SCIENTIFIC SATELLITES **c19**
Keiken Ninomiya, Y. Ogawara, Y. Kameda, and Tsuguhiko Okamoto *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 301-306 (For primary document see N87-25354 19-18)
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A two-dimensional fine Sun sensor using linear CCDs is described. The sensor has a wide rectangular field of view of 50 deg by 50 deg around its normal, with angular resolution of 0.025 deg. The sensor was developed as one of applications of CCDs to spacecraft and is to fly for the first time on ASTRO-C, an X-ray astronomy research satellite which also incorporates onboard a set of star trackers using area CCDs. Through the performance and environmental tests on the sensor unit, it was qualified to meet all the requirements. Development of a CCD Sun sensor with higher accuracy is mentioned. ESA

N87-25393# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
AN EXPERIMENTAL INVESTIGATION OF SPACECRAFT SLOSHING
J. J. Pocha *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 307-314 (For primary document see N87-25354 19-18)
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Slosh testing of the Eurostar spacecraft is described. The spacecraft contains 1 ton of propellant on board, with a significant influence upon its dynamic characteristics. To define these, a series of drop tests was undertaken. The nutation time constant was the principal parameter of interest. The testing involved dynamical scaling, model fabrication, and all data capture and analysis. Initial tests indicate very short time constants and corrective action is necessary. This involved designing internal baffles to modify the fluid motion. ESA

N87-25394# Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen (West Germany).
INTERPOLATION OF PERFORMANCE PARAMETERS FOR CATALYTIC HYDRAZINE THRUSTERS **c20**
W. Kollien and J. Weiss *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 315-319 Sponsored by ESA (For primary document see N87-25354 19-18)
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An algorithm which allows calculation of time dependent thrust force shapes over a wide range of thruster pulse modes and fuel supply pressures is described. Figures of the algorithm parameters are given with respect to a 2N hydrazine thruster. Results of an accuracy check comparing measured and calculated performance data are presented. ESA

N87-25395# Politecnico di Milano (Italy). Dipt. Ingegneria Aerospaziale.
AUTOMATIC DOCKING MANEUVER AND ATTITUDE CONTROL SYSTEM
Amalia Ercoli Finzi and F. Venditti *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 321-326 (For primary document see N87-25354 19-18)
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The interaction between the automatic docking maneuver and the attitude dynamics of the involved spacecraft is analyzed, as far as the docking maneuver behavior is concerned. Three different docking concepts are investigated by dedicated computer dynamics simulation programs. The simulations consider rigid bodies and the presence of a flexible element between the docking port and the main body on one spacecraft; and with the docking port axis on each vehicle aligned with the center of mass and with large

arms with respect to it. The need for proper attitude control systems is established; the importance of energy dissipation sources is shown. ESA

N87-25396# Technische Hochschule, Darmstadt (West Germany).
FAST NUMERICAL INTEGRATION OF INTERPLANETARY ORBITS **c13**
Frank Debatin, A. Tilgner, and Friedhelm Hechler *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 329-333 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

Mathematical considerations on the stability of the numerical integration of interplanetary orbits lead to a step-size control for the time that minimizes the computation time. The controls are derived from the eigenvalues of the Jacobian of the right-hand sides of Newton's equations of motion. It is shown that the implementation of this control into a multistep method of constant step-size by a time regularization has disadvantages. They can be avoided by integrating the equations of motion by a multistep method with variable step-sizes like Nordsieck's. Initialization problems and the computation of the coefficients of the difference equations for higher order methods are discussed. ESA

N87-25397# Zaragoza Univ. (Spain). Dept. Fisica de la Tierra y del Cosmos.
THE USE OF EULER PARAMETERS IN THE ROTATION OF A SATELLITE NEAR L4 **c13**
A. Abad, M. Arribas, and A. Elipe *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 335-338 (For primary document see N87-25354 19-18)
(Contracts DGA-CB4/85; CAICYT-Proj-779-84)
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The rotational motion of a rigid body satellite whose center of mass is moving near the libration point L4 is studied using the Euler parameters. The Hamiltonian form of the equations of motion is obtained, and inherent difficulties of the problem (singularities, triaxial complexity, etc) do not appear. ESA

N87-25398# Rome Univ. (Italy). Dipt. Aerospaziale.
LONG-TERM ORBIT PREDICTION OF HIGH-ALTITUDE EARTH SATELLITES **c13**
Carlo Ulivieri and A. Agneni *In* ESA Proceedings of the Second Intenational Symposium on Spacecraft Flight Dynamics Dec. 1986 p 339-344 Sponsored by CNR (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

The long-period evolution of the orbital plane of uncontrolled high-altitude Earth satellites, under luni-solar gravitational effects, which can be independently treated with a good approximation from the other long-term perturbative effects was investigated. Since computer programs usually employed for orbit prediction during the satellite operational life are very time-consuming, a semianalytical model for geostationary orbits, that reduces computer time and provide sufficient accuracy over very long periods was extended to any orbital inclination for high altitude satellites. Orbits highly affected by the motion of the lunar orbital plane were investigated. ESA

N87-25399# National Bureau of Standards, Gaithersburg, Md.
TIME TRANSFORMATION AND LINEARIZATION ON RADIAL INTERMEDIARIES IN THE ZONAL EARTH ARTIFICIAL SATELLITE THEORY **c13**
S. Ferrer and M. L. Sein-Echaluce (Zaragoza Univ., Spain) *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 345-348 Sponsored by Diputacion General de Aragon, and the Spanish Asesora Interministerial Cientifica y Tecnica (For primary document see N87-25354 19-18)
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It is shown that in artificial satellite theory, even including all zonal coefficients, Cid-Deprit's radial intermediary defines a system with only one degree of freedom describing the spacecraft's radial motion. In the case of small eccentricities, appropriate truncation of negligible terms produces a system integrable in closed form by elliptic integrals, giving r as a harmonic oscillator, provided the independent variable be changed to either a true or an eccentric anomaly. The solution is simple and concise enough to serve as the basis of an ephemeris generator running in real time on board a satellite. ESA

N87-25400# Academia Sinica, Beijing (China). Space Science and Technology Center.
THE NEWTON-RAPHSON METHOD IN ORBIT DETERMINATION **c13**
Huai-bao Gao, Ker-zhuong Luo, and Wen-ling Huang *In* ESA Proceedings of the Second International Symposium on the Spacecraft Flight Dynamics Dec. 1986 p 349-354 (For primary document see N87-25354 19-18)
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Applications of the Newton-Raphson iterative method to artificial satellite orbit determination are reviewed. Solution of the nonlinear algebraic equation system is discussed and the convergence of the method is investigated. In the numerical examples, the equation which describes the motion of the satellite is the equation of the two-body motion. The state equation can involve any acting forces. ESA

N87-25401# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ONBOARD ORBIT DETERMINATION USING DATA RELAY SATELLITES **c13**
Van-Nhan Nguyen *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 355-360 Sponsored by CNES (For primary document see N87-25354 19-18)
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An onboard orbit determination method for a low Earth orbiter, using range and/or Doppler measurements transiting via one or two data relay satellites is presented. The estimation method relies on a Kalman filtering algorithm. Simple but sufficiently accurate modeling techniques, allowing to take into account uncertainties due to Earth potential, atmospheric drag, and propulsion errors during a maneuver, are illustrated by application examples. ESA

N87-25402# Polytechnical Univ. of Madrid (Spain). Dept. Mathematica Aplicada a la Tecnica.
A NEW SET OF CANONICAL VARIABLES FOR ORBIT CALCULATION **c13**
Jose M. Ferrandiz *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 361-364 (For primary document see N87-25354 19-18)
(Grant CB2/85)
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A canonical transformation which is useful to describe the orbital motion of a particle, and involves redundant variables is presented. It is shown that it shares interesting properties with the KS transformation. When the perturbation comes from the oblateness of the primary body, it seems reasonable to use the canonical equations, because their right hand parts result in polynomial expressions. In any case, it can be used to reduce the two body problem to four harmonic oscillators. Their common frequency is equal to one if a new time coincident with the true anomaly is used. This transformation could be used as an alternative method for an efficient calculation of orbits. ESA

N87-25403# British Aerospace Public Ltd. Co., Bristol (England). Space and Communications Div.
HIPPARCOS ON-BOARD ATTITUDE DETERMINATION
W. W. Black and W. Salter *In* ESA Proceedings of the Second International Symposium on Spacacraft Flight Dynamics Dec. 1986 p 367-378 (For primary document see N87-25354 19-18)
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Derivation of the HIPPARCOS on-board attitude determination algorithm which is required to give an estimate of the payload pointing to within 1 arcsec rms is described. It is shown how the predicted performance of the suboptimum Kalman filter based algorithm was assessed by computer simulation. Performance of the algorithm predicted by the simulation is assessed. The performance predicted for normal sunlit operation which covers over 93% of the mission is within the specification. Eclipse, stationkeeping, and occultation problems can be overcome. ESA

N87-25404# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
HIPPARCOS PRECISE ATTITUDE DETERMINATION: A BALANCE BETWEEN ON-BOARD AND ON-GROUND CAPABILITIES
Jozef vanderHa and Simon P. Caldwell *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 385-393 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

The design philosophy and task distribution between on-board and on-ground capabilities for ensuring the precise attitude determination requirements needed for a successful completion of the HIPPARCOS mission objectives are summarized. The stringent realtime on-board attitude determination accuracy of 1 arcsec (rms) for the telescope pointing directions during the normal operational mode is achievable only by continuous ground support in terms of uplinking star position information and ground monitoring of the on-board attitude estimation process. More extensive ground support is required during mission phases where the flexibility of the on-board process is insufficient for reaching or sustaining the demanded attitude determination accuracies. The ground-spacecraft interactions during these critical phases, e.g., initialization of the on-board attitude estimation, as well as during occultation periods, are discussed. ESA

N87-25405# Politecnico di Torino (Italy). Dipt. di Automatica e Informatica.
ON-GROUND ATTITUDE RECONSTITUTION OF THE HIPPARCOS SATELLITE c13
E. Canuto and F. Donati *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 379-384 Sponsored by CNR (For primary document see N87-25354 19-18)
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The on-ground attitude reconstitution performed off-line with a target precision better than 0.1 arcsec rms during the reduction of the astrometric data transmitted by the HIPPARCOS satellite is discussed. To achieve this target, a minimum variance estimator of the satellite three-axes attitude, which processes on-board star mapper data, was designed and implemented. Trials performed under severe simulated conditions prove that the target precision is reached with a good margin. ESA

N87-25406# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Space Operations Center.
ATTITUDE DETERMINATION AND CONTROL FOR THE X-RAY SATELLITE ROSAT
M. Bollner and G. Schneiders *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 397-402 (For primary document see N87-25354 19-18)
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The ROSAT Attitude Measurement and Control Subsystem (AMCS) is described. The satellite is three-axis stabilized using reaction wheels, gyros, and imaging star cameras as main attitude devices. According to the mission timeline AMCS operations must be supplied on ground. A large number of commands for orbit/ephemeris data, star catalogs, and scan and pointing catalog is required. For post facto attitude determination star camera measurements and gyro data are used, the latter replace the model in a Kalman filter. A quaternion representation of the attitude is used. A fiducial light system monitors the relative motion between telescope axis and star cameras. The reference is a star catalog for the epoch 2000.0. ESA

N87-25407# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
ATTITUDE RECONSTRUCTION FILTERS: YES OR NO?
L. Fraiture *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 403-414 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

Studies of attitude estimation for spinning satellites by different filtering approaches are reviewed. Communalities which could explain the poor attitude estimation performance found in almost all cases are discussed. It is shown that increased modeling complexity brought about by including either the nutation dynamics or sensor biases, leads to estimation inability in the former case and increased inaccuracy in the latter. It is suggested that the accuracy decrease experienced by supplementary bias estimation is a natural phenomenon rather than a linearization problem. Supporting evidence is provided by numerical experiments. ESA

N87-25408# Tokyo Univ. (Japan). Inst. of Space and Astronautical Science.
ATTITUDE DETERMINATION FOR JAPAN'S FIRST INTERPLANETARY FLIGHTS, SAKIGAKE AND SUISEI
K. Ninomiya, N. Muranaka, and M. Uo *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 415-420 (For primary document see N87-25354 19-18)
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The attitude determination system for Japan's Halley explorers Sakigake and Suisei consists of a Sun sensor and a star scanner and ground based attitude determination software (ADS). The essential feature of ADS is autonomous star identification (SID) and attitude/bias estimation (ABE). The SID identifies the stars without a priori attitude knowledge utilizing angular separation match technique. The ABE utilizes a sequential least-squares method to achieve overall attitude determination accuracy within 0.1 deg. The system, SID and ABE algorithms, the system verification method, and the flight results are described. ESA

N87-25409# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
INFLIGHT EXPERIENCE WITH THE ESA STARMAPPER DURING THE GIOTTO MISSION c89
J. Fertig *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 421-427 (For primary document see N87-25354 19-18)
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The Giotto star mapper flight hardware and ground processing software, and the inflight performance of the overall star mapper attitude determination system are discussed. The star mapper datates transit times of stars or planets through a Vee shaped detector slit pattern. The datated events are transmitted to ground for processing. A ground based starmapper attitude determination system performs telemetry preprocessing, star pattern identification, and attitude reconstitution. The Halley mission shows the sensor to have low measurement noise, but susceptibility to spurious events. Real time star pattern recognition and attitude determination with accuracy within 0.1 deg was maintained throughout the mission. ESA

N87-25410# Rockwell International Corp., Houston, Tex.
MANNED SPACEFLIGHT TRAJECTORY OPERATIONS: THE DIFFERENCES c13
R. K. Osburn *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 431-442 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

Manned and unmanned flight dynamics operations for past and present United States spaceflight projects are compared. Capabilities for attitude determination, orbit determination, and orbit prediction are reviewed. Space Transportation System flight

dynamics operations are documented, including ground and onboard attitude determination, attitude maintenance and prediction, ground and onboard orbit determination, orbit maintenance, and orbit prediction. Operational aspects of manned spacecraft flight dynamics problem are contrasted with those associated with unmanned projects. ESA

N87-25411# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
DOPPLER MEASUREMENTS AS A SOURCE OF ATTITUDE INFORMATION FOR THE ULYSSES SPACECRAFT
J. A. Massart and A. Schueltz *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 443-454 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

Attitude control of the Ulysses interplanetary spacecraft is discussed. When the spacecraft's spin axis is not pointed to the Earth, the capability of the attitude measurement system is limited to the determination of the spin period and the Sun aspect angle. This limitation is highly critical for the first few days after the injection and for the first Trajectory Correction Maneuver (TCM). It is shown that Doppler radiometric measurements, collected primarily to estimate the spacecraft trajectory, are a valuable source of attitude information and that the attitude and orbit control system can be fully calibrated in flight using Doppler and Sun data. These techniques can be used to determine the spacecraft attitude after injection and to ensure that the first TCM is accurately carried out. ESA

N87-25412# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
REVIEW OF ESA TRACKING FACILITIES AND THEIR CONTRIBUTION TO THE ORBIT DETERMINATION **c14**
S. Pallaschke, M. Schaefer, and O. Mikkelsen (Computer Resources International A/S, Denmark) *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 457-465 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

The ESA tracking facilities operating in S-band and higher frequencies are reviewed. There are three systems: tone ranging; data acquisition, telecommand, and tracking; and deep space tracking. Tracking measurement types are range, Doppler, and antenna angles. Practical knowledge was gained during the operation of several satellites and the performance experienced is described. The usefulness of these tracking measurements for satellite position determination of common orbit types is discussed. ESA

N87-25413# Centre National d'Etudes Spatiales, Toulouse (France).
CARTEL: A METHOD TO CALIBRATE S-BAND RANGES WITH GEOSTATIONARY SATELLITES **c13**
A. Guitart, R. Mesnard, and F. Nouel *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 467-471 (For primary document see N87-25354 19-18)
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An intersite tracking campaign was organized, with 4 S-band stations, for a period of 1 wk to show how the most precise orbit can be computed with the operational software. This precise orbit served as a reference in order to evaluate what can be achieved with one single station with range and angular measurements (a typical configuration used for stationkeeping of geostationary satellites). Orbit computation implied numerical integration with gravitational (Earth, Moon, and Sun) and solar radiation pressure as forces acting on the satellite. Arc lengths of 2 days gave initial state vectors which were compared every day. A precision of 10 m is achieved. However, an analysis of the influence of several parameters entering the orbit computations reveals that the absolute accuracy is of the order of 100 m, since modeling perturbations were neglected in the operational software (polar motion for example). This reference orbit allows estimation of systematic errors for other tracking antennas. ESA

N87-25414# Centre National d'Etudes Spatiales, Toulouse (France).
MERCATOR: A NEW GROUND SYSTEM FOR ORBIT AND ATTITUDE CONTROL
B. Belon, J. C. Berges, G. Campan, and P. Legendre *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 475-479 (For primary document see N87-25354 19-18)
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An attitude and orbit control system under development is described. Hardware and software choices are presented, and examples of algorithms are shown. ESA

N87-25415# National Space Development Agency, Ibaraki (Japan).
NATIONAL SPACE DEVELOPMENT AGENCY'S (NASDA) OPERATIONAL ORBIT COMPUTATION SYSTEM FOR LATE 80'S **c13**
A. Yamamoto, M. Sawabe, Y. Fujita, T. Shimizu, Y. Katsumata, and T. Morimoto (Fujitsu Ltd., Tokyo, Japan) *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 481-486 (For primary document see N87-25354 19-18)
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Orbit determinations for Japanese Earth orbiting satellites used for Earth observation like the Marine Observation Satellite (MOS-1) expected to be launched early in 1987 are discussed. A system was developed to improve processing capability by introducing semiautomatic processing functions, as well as the system accuracy. Tests with one laser ranging site using the geodetic payload on TF-1 satellite show decimeter accuracy and orbital elements in good agreement with NASA's. Semiautomatic performance are excellent. ESA

N87-25416# Saab-Scania, Linkoping (Sweden).
THE SWEDISH VIKING SATELLITE: THE CONCEPT AND IN-ORBIT EXPERIENCES
L. Ljunge *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 487-492 (For primary document see N87-25354 19-18)
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The general Viking design is described. The attitude control system design is presented and flight results are given, along with a judgement of the concept. The analyses of the Viking dynamics are mentioned. The low cost satellite passed its 8 month design life and continues to acquire magnetospheric data including high-quality UV images of the auroral activity over the Northern Hemisphere. ESA

N87-25417# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
LOOPS IN ORBITAL OCCUPIED PERMANENTLY BY UNSTATIONARY SATELLITES (LOOPUS): AN ALTERNATIVE FOR GEOSTATIONARY COMMUNICATION SATELLITE [LOOPUS: EINE ALTERNATIVE ZU GEOSTATIONAEREN FERNMELDESATELLITEN]
Peter Dondl and Thomas Goerlach 1986 14 p In GERMAN Presented at the 35th Hermann-Oberth-Gesellschaft (HOG) e.V. Raumfahrtkongress, Garmisch-Partenkirchen, West Germany, 2-4 Oct. 1986
(MBB-UR-E-920/86; ETN-87-99953) Avail: Issuing Activity

The LOOPUS concept, a system of geostationary loops in orbit which are permanently occupied by unstationary satellites, is presented. This concept could be a solution for the increasing closeness of communication satellites in geosynchronous orbit. The orbit parameters of the LOOPUS satellites are determined in such a way that there is always one satellite in a given loop, enabling a permanent communication as for geostationary satellites. The LOOPUS system could improve the coverage of regions above the 70th parallel, and allow communication between very distant locations (e.g., USA-Japan); it has no transmitter and receiver activities in the shadow phases. ESA

N87-25418# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
POSSIBILITIES OF THE FURTHER DEVELOPMENT OF COLUMBUS TO AN AUTONOMOUS EUROPEAN SPACE STATION [MOEGLICHKEITEN DER WEITERENTWICKLUNG VON COLUMBUS ZU EINER AUTONOMEN EUROPAEISCHEN RAUMSTATION]
W. Wienss 1986 22 p In GERMAN Presented at the 35th Hermann-Oberth-Gesellschaft (HOG) e.V. Raumfahrtkongress, Garmisch-Partenkirchen, West Germany, 2-4 Oct. 1986
(MBB-UR-E-922/86; ETN-87-99955) Avail: Issuing Activity

The Columbus program and conceptual ideas for an autonomous, permanently manned space station Columbus are presented. The Columbus program, in its present state of definition, is discussed, with emphasis on the Man-Tended Freeflyer which is the key element for each potential autonomous European space station. The functions of such a space station and the infrastructure in space required for its operation are treated. ESA

N87-25419*# Ohio State Univ., Columbus. ElectroScience Lab.
MATHEMATICAL PROGRAMMING FORMULATIONS FOR SATELLITE SYNTHESIS
Puneet Bhasin and Charles H. Reilly Jul. 1987 113 p
(Grant NAG3-159)
(NASA-CR-181151; NAS 1.26:181151; TR-718688-4) Avail: NTIS HC A06/MF A01 CSCL 22B

The problem of satellite synthesis can be described as optimally allotting locations and sometimes frequencies and polarizations, to communication satellites so that interference from unwanted satellite signals does not exceed a specified threshold. In this report, mathematical programming models and optimization methods are used to solve satellite synthesis problems. A nonlinear programming formulation which is solved using Zoutendijk's method and a gradient search method is described. Nine mixed integer programming models are considered. Results of computer runs with these nine models and five geographically compatible scenarios are presented and evaluated. A heuristic solution procedure is also used to solve two of the models studied. Heuristic solutions to three large synthesis problems are presented. The results of our analysis show that the heuristic performs very well, both in terms of solution quality and solution time, on the two models to which it was applied. It is concluded that the heuristic procedure is the best of the methods considered for solving satellite synthesis problems. Author

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N87-25391# Technische Physische Dienst TNO-TH, Delft (Netherlands).
THE TECHNISCH PHYSISCHE DIENST (TPD) OFF-AXIS STAR TRACKER (TOAST)
H. Bokhove, P. P. Jonker, L. W. vanderKolk, and C. Roos *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 295-299 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25392# Toshiba Research and Development Center, Kawasaki (Japan).
CCD FINE SUN SENSOR FOR SCIENTIFIC SATELLITES
Keiken Ninomiya, Y. Ogawara, Y. Kameda, and Tsuguhiko Okamoto *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 301-306 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25939# Max-Planck-Inst. fuer Kernphysik, Heidelberg (West Germany).
PERFORMANCE OF THE IMPACT PLASMA AND MOMENTUM DETECTOR (DIDSY-IPM) BEFORE CLOSEST APPROACH TO COMET HALLEY
G. Lange, E. Gruen, D. Maas, J. R. Goeller, J. Kissel, E. Bussoletti, J. A. M. McDonnell, J. C. Zarnecki (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands), and R. J. L. Grard *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 191-193 (For primary document see N87-25908 19-90)
(Grants BMFT-01-OF-0726; BMFT-01-OF-85-0610)
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20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxilliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N87-25420*# Georgia Inst. of Tech., Atlanta.
TECHNOLOGY FOR SATELLITE POWER CONVERSION Final Technical Report
M. A. Gouker, D. P. Campbell, and J. J. Gallagher 30 Jun. 1987 110 p
(Grant NAG3-282)
(NASA-CR-181057; A-3244; NAS 1.26:181057) Avail: NTIS HC A06/MF A01 CSCL 14B

Components were examined that will be needed for high frequency rectenna devices. The majority of the effort was spent on measuring the directivity and efficiency of the half-wave dipole antenna. It is felt that the antenna and diode should be roughly optimized before they are combined into a rectenna structure. An integrated low pass filter had to be added to the antenna structure in order to facilitate the field pattern measurements. A calculation was also made of the power density of the Earth's radiant energy as seen by satellites in Earth orbit. Finally, the feasibility of using a Metal-Oxide-Metal (MOM) diode for rectification of the received power was assessed. B.G.

N87-25421# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
AFRPL (AIR FORCE ROCKET PROPULSION LABORATORY) TECHNICAL OBJECTIVE DOCUMENT FY88
Mar. 1987 86 p
(AD-A180110; AFRPL-TR-87-016) Avail: NTIS HC A05/MF A01 CSCL 21H

This report is a summary of technical objectives and approaches for research, exploratory development, and advanced development efforts being pursued, and to be pursued, at the Air Force Rocket Propulsion Laboratory between FY87-91. GRA

N87-25422*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE STATION PROPULSION SYSTEM TECHNOLOGY
Robert E. Jones, Phillip R. Meng, Steven J. Schneider, James S. Sovey, and Robert R. Tacina 1987 18 p Proposed for presentation at the 38th International Astronautical Federation Congress, Brighton, England, 10-17 Oct. 1987
(NASA-TM-100108; E-3648; NAS 1.15:100108) Avail: NTIS HC A02/MF A01 CSCL 21H

Two propulsion systems have been selected for the space station: O/H rockets for high thrust applications and the multipropellant resistojets for low thrust needs. These thruster systems integrate very well with the fluid systems on the station. Both thrusters will utilize waste fluids as their source of propellant.

The O/H rocket will be fueled by electrolyzed water and the resistojets will use stored waste gases from the environmental control system and the various laboratories. This paper presents the results of experimental efforts with O/H and resistojet thrusters to determine their performance and life capability. Author

N87-25423*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPARISON OF THEORETICAL AND EXPERIMENTAL THRUST PERFORMANCE OF A 1030:1 AREA RATIO ROCKET NOZZLE AT A CHAMBER PRESSURE OF 2413 kN/m2 (350 PSIA)

Tamara A. Smith, Albert J. Pavli, and Kenneth J. Kacynski 1987 25 p Presented at the 23rd Joint Propulsion Conference, San Diego, Calif., 29 Jun. - 2 Jul. 1987; sponsored by AIAA, SAE, ASME and ASEE

(NASA-TP-2725; E-3523; NAS 1.60:2725; AIAA-87-2069) Avail: NTIS HC A02/MF A01 CSCL 21H

The joint Army. Navy, NASA. Air Force (JANNAF) rocket engine peformnace prediction procedure is based on the use of various reference computer programs. One of the reference programs for nozzle analysis is the Two-Dimensional Kinetics (TDK) Program. The purpose of this report is to calibrate the JANNAF procedure incorporated into the December l984 version of the TDK program for the high-area-ratio rocket engine regime. The calibration was accomplished by modeling the performance of a 1030:1 rocket nozzle tested at NASA Lewis Research Center. A detailed description of the experimental test conditions and TDK input parameters is given. The results show that the computer code predicts delivered vacuum specific impulse to within 0.12 to 1.9 percent of the experimental data. Vacuum thrust coefficient predictions were within + or - 1.3 percent of experimental results. Predictions of wall static pressure were within approximately + or - 5 percent of the measured values. An experimental value for inviscid thrust was obtained for the nozzle extension between area ratios of 427.5 and 1030 by using an integration of the measured wall static pressures. Subtracting the measured thrust gain produced by the nozzle between area ratios of 427.5 and 1030 from the inviscid thrust gain yielded experimental drag decrements of 10.85 and 27.00 N (2.44 and 6.07 lb) for mixture ratios of 3.04 and 4.29, respectively. These values correspond to 0.45 and 1.11 percent of the total vacuum thrust. At a mixture ratio of 4.29, the TDK predicted drag decrement was 16.59 N (3.73 lb), or 0.71 percent of the predicted total vacuum thrust. Author

N87-25424*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL EVALUATION OF HEAT TRANSFER ON A 1030:1 AREA RATIO ROCKET NOZZLE

Kenneth J. Kacynski, Albert J. Pavli, and Tamara A. Smith Aug. 1987 28 p Presented at the 23rd Joint Propulsion Conference, San Diego, Calif., 29 Jun. - 2 Jul. 1987; sponsored by AIAA, SAE, ASME and ASEE

(NASA-TP-2726; E-3558; NAS 1.60:2726; AIAA-87-2070) Avail: NTIS HC A03/MF A01 CSCL 21H

A 1030:1 carbon steel, heat-sink nozzle was tested. The test conditions included a nominal chamber pressure of 2413 kN/sq m and a mixture ratio range of 2.78 to 5.49. The propellants were gaseous oxygen and gaseous hydrogen. Outer wall temperature measurements were used to calculate the inner wall temperature and the heat flux and heat rate to the nozzle at specified axial locations. The experimental heat fluxes were compared to those predicted by the Two-Dimensional Kinetics (TDK) computer model analysis program. When laminar boundary layer flow was assumed in the analysis, the predicted values were within 15% of the experimental values for the area ratios of 20 to 975. However, when turbulent boundary layer conditions were assumed, the predicted values were approximately 120% higher than the experimental values. A study was performed to determine if the conditions within the nozzle could sustain a laminar boundary layer. Using the flow properties predicted by TDK, the momentum-thickness Reynolds number was calculated, and the point of transition to turbulent flow was predicted. The predicted transition point was within 0.5 inches of the nozzle throat. Calculations of the acceleration parameter were then made to determine if the flow conditions could produce relaminarization of the boundary layer. It was determined that if the boundary layer flow was inclined to transition to turbulent, the acceleration conditions within the nozzle would tend to suppress turbulence and keep the flow laminar-like. M.G.

N87-25425*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF QUASI-HYBRID SOLID ROCKET BOOSTER CONCEPTS FOR ADVANCED EARTH-TO-ORBIT VEHICLES

Robert L. Zurawski and Douglas C. Rapp (Sverdrup Technology, Inc., Cleveland, Ohio.) Aug. 1987 32 p Presented at the 23rd Joint Propulsion Conference, San Diego, Calif. 29 Jun. - 2 Jul. 1987; sponsored by AIAA, SAE, ASME and ASEE

(NASA-TP-2751; E-3554; NAS 1.60:2751; AIAA-87-2082) Avail: NTIS HC A03/MF A01 CSCL 21H

A study was conducted to assess the feasibility of quasi-hybrid solid rocket boosters for advanced Earth-to-orbit vehicles. Thermochemical calculations were conducted to determine the effect of liquid hydrogen addition, solids composition change plus liquid hydrogen addition, and the addition of an aluminum/liquid hydrogen slurry on the theoretical performance of a PBAN solid propellant rocket. The space shuttle solid rocket booster was used as a reference point. All three quasi-hybrid systems theoretically offer higher specific impulse when compared with the space shuttle solid rocket boosters. However, based on operational and safety considerations, the quasi-hybrid rocket is not a practical choice for near-term Earth-to-orbit booster applications. Safety and technology issues pertinent to quasi-hybrid rocket systems are discussed. Author

N87-25426*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LOW REYNOLDS NUMBER NOZZLE FLOW STUDY M.S. Thesis

Margaret V. Whalen Jul. 1987 45 p

(NASA-TM-100130; E-3679; NAS 1.15:100130) Avail: NTIS HC A03/MF A01 CSCL 21H

An experimental study of low Reynolds number nozzle flow was performed. A brief comparison was made between some of the experimental performance data and performance predicted by a viscous flow code. The performance of 15, 20, and 25 deg conical nozzles, bell nozzles, and trumpet nozzles was evaluated with unheated nitrogen and hydrogen. The numerical analysis was applied to the conical nozzles only, using an existing viscous flow code that was based on a slender-channel approximation. Although the trumpet and 25 deg conical nozzles had slightly better performance at lower Reynolds numbers, it is unclear which nozzle is superior as all fell within the experimental error band. The numerical rssults were found to agree with experimental results for nitrogen and for some of the hydrogen data. Some code modification is recommended to improve confidence in the performance prediction. Author

N87-25394# Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen (West Germany).

INTERPOLATION OF PERFORMANCE PARAMETERS FOR CATALYTIC HYDRAZINE THRUSTERS

W. Kollien and J. Weiss *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 315-319 Sponsored by ESA (For primary document see N87-25354 19-18)

Copyright Avail: NTIS HC A22/MF A01

23 CHEMISTRY AND MATERIALS (GENERAL)

N87-25427# Mound Lab., Miamisburg, Ohio.
MATERIALS SCIENCE AND CHARACTERIZATION: TECHNOLOGY UPDATE-87
P. A. Fitzharris, ed. Feb. 1987 27 p
(Contract DE-AC04-76DP-00053)
(DE87-008396; MLM-3419) Avail: NTIS HC A03/MF A01

Five articles are included on: glass-ceramics, failure analysis, powder characterization, ion implantation, and polymer characterization. DOE

N87-25428# Naval Research Lab., Washington, D. C.
THE USE OF ION IMPLANTATION FOR MATERIALS PROCESSING Annual Progress Report, 1 Oct. 1984 - 30 Sep. 1985
F. A. Smidt 31 Dec. 1986 312 p
(AD-A180444; NRL-MR-5898) Avail: NTIS HC A14/MF A01
CSCL 07E

An interdisciplinary program on the use of ion implantation for materials processing is being conducted at NRL. This report describes the important factors in ion implantation science and technology and reports progress in the use of ion implantation to modify friction, wear, fatigue, corrosion, optical and magnetic properties of materials. GRA

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

For ceramic materials see *27 Nonmetallic Materials*.

N87-25429# Kernforschungszentrum, Karlsruhe (West Germany).
DEVELOPMENT AND TESTING OF A PRODUCTION PLANT FOR THE SERIES PRODUCTION OF FIBER COMPOSITE COMPONENTS WITH HIGH-LOAD CAPACITY
E. Holstein Feb. 1986 85 p In GERMAN; ENGLISH summary
Sponsored by Bundesministerium fuer Forschung und Technologie
(KfK-PFT-118; ETN-87-99656) Avail: NTIS HC A05/MF A01

A plant for the series production of precision fiber-compound components with strong anisotropy and high vibrational load capacity was developed and tested. A manufacturing process for complicated, highly stressed fiber-polyurethane-foam compound parts was designed. A production method was realized for rotor blades of flapping-hinge wind power plants, allowing the mechanization of the manual laminating operations. Reproducable unit weights and fiber directions were obtained, and inserted parts can be bonded to the skin in the same process. Nondestructive quality-assurance measures were checked; the mass distribution procedure was developed in an operational form. A small-scale production method for a diaphragm shaft was developed. ESA

N87-25430# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
FIBER COMPOSITES IN SATELLITES
Armin Schedler 28 Jul. 1986 16 p Presented at the Conference on ICMC Nonmetallic Materials and Composites at Low Temperatures 4, Heidelberg, West Germany, 28-29 Jul. 1986
(MBB-UD-492/86; ETN-87-99932) Copyright Avail: Issuing Activity

The advantages of the low specific weight, high strength, and adjustable values of stiffness, thermal expansion, and thermal conductivity of fiber composites for spacecraft construction are reviewed. Utilizations between 4 and 450K are illustrated. ESA

N87-25431# Army Materials Technology Lab., Watertown, Mass.
TRANSMISSION ELECTRON MICROSCOPY STUDY OF ALUMINA FIBER-REINFORCED MAGNESIUM COMPOSITE Final Report
Ernest S. Chin Jan. 1987 23 p
(AD-A179912; MTL-TR-87-7) Avail: NTIS HC A02/MF A01
CSCL 11D

A detailed microstructural analysis of alumina (FP) fiber-reinforced ZE41A magnesium composite was performed by means of transmission electron microscopy (TEM). Fifty-five volume percent FP fiber-reinforced ZE41A magnesium composite thin foils were prepared by methods of mechanical polishing and ion thinning. Three major areas of interest in the composite microstructure were studied; the filaments, the interface (fiber/matrix reaction zone), and the matrix. In addition, the effects of heat treatments at 450 C on the composite microstructure were investigated. It was found that the alumina/magnesium interface consisted of a thin layer of magnesium aluminum oxide spinel and relatively large magnesium oxide (MgO) particles. A concentric layer of magnesium alloy grains encircling the alumina filaments was also observed. MgZn precipitates were also identified within the magnesium matrix microstructures. Upon heat treatment at 450 C for 95 hours, polygonization of the magnesium matrix occurred while the spinel interfacial layer grew with decreasing magnesium oxide particle size. GRA

N87-25432*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SILSESQUIOXANES AS PRECURSORS TO CERAMIC COMPOSITES
Frances I. Hurwitz, Lizbeth H. Hyatt, Joy Gorecki, and Lisa DAmore Jan. 1987 16 p Presented at the 11th Annual Conference on Composites, Advanced Ceramics, and Composite Materials, Cocoa Beach, Fla., 18-23 Jan. 1987; cosponsored by NASA, American Ceramic Society and DOD
(NASA-TM-89893; E-3581; NAS 1.15:89893) Avail: NTIS HC A02/MF A01 CSCL 11D

Silsesquioxanes having the general structure RSiO sub 1.5, where R = methyl, propyl, or phenyl, melt flow at 70 to 100 C. Above 100 C, free -OH groups condense. At 225 C further crosslinking occurs, and the materials form thermosets. Pyrolysis, with accompanying loss of volatiles, takes place at nominally 525 C. At higher temperatures, the R group serves as an internal carbon soruce for carbo-thermal reduction to SiC accompanied by the evolution of CO. By blending silsesquioxanes with varying R groups, both the melt rheology and composition of the fired ceramic can be controlled. Fibers can be spun from the melt which are stable in argon in 1400 C. The silsesquioxanes also were used as matrix precursors for Nicalon and alpha-SiC platelet reinforced composites. Author

N87-25433# Colorado Univ., Boulder. Dept. of Mechanical Engineering.
DYNAMIC BEHAVIOR OF FIBER AND PARTICLE REINFORCED COMPOSITES Annual Report, 21 Apr. 1986 - 20 Apr. 1987
Subhendu K. Datta 28 Apr. 1987 5 p
(Contract N00014-86-K-0280)
(AD-A180204; CUMER-1531738) Avail: NTIS HC A02/MF A01
CSCL 11D

Full anisotropic behavior of fiber reinforced composites has been studied. Comparison of model predictions with available experiments shows excellent agreement. This also allows the determination of anisotropic fiber properties in an inverse fashion. We have also studied the frequency dependence of phase velocities and attenuation in a particle reinforced composite allowing for the effect of non-perfect interfaces. Simultaneously we have examined ultrasonic scattering by surface-breaking cracks. In particular, we have studied the effect of crack branches on the ultrasonic signal. Scattering of ultrasonic SH waves by buried canted cracks in a thick plate has also been investigated. Here the results of calculations show excellent agreement with available experiments. GRA

N87-25434*# Hercules Aerospace Co., Magna, Utah.
THE SURFACE PROPERTIES OF CARBON FIBERS AND THEIR ADHESION TO ORGANIC POLYMERS
W. D. Bascom and L. T. Drzal (Michigan State Univ., East Lansing.) Washington NASA Jul. 1987 96 p
(Contract NAS1-17918)
(NASA-CR-4084; NAS 1.26:4084) Avail: NTIS HC A05/MF A01 CSCL 11D

The state of knowledge of the surface properties of carbon fibers is reviewed, with emphasis on fiber/matrix adhesion in carbon fiber reinforced plastics. Subjects treated include carbon fiber structure and chemistry, techniques for the study of the fiber surface, polymer/fiber bond strength and its measurement, variations in polymer properties in the interphase, and the influence of fiber matrix adhesion on composite mechanical properties. Critical issues are summarized and search recommendations are made. Author

N87-25435*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY STRUCTURAL DESIGN OF COMPOSITE MAIN ROTOR BLADES FOR MINIMUM WEIGHT
Mark W. Nixon Jul. 1987 28 p Prepared in cooperation with Army Aviation Research and Development Command, Hampton, Va.
(DA Proj. 1L1-62209-AH-76)
(NASA-TP-2730; L-16310; NAS 1.60:2730; AVSCOM-TM-87-B-6) Avail: NTIS HC A03/MF A01 CSCL 11D

A methodology is developed to perform minimum weight structural design for composite or metallic main rotor blades subject to aerodynamic performance, material strength, autorotation, and frequency constraints. The constraints and load cases are developed such that the final preliminary rotor design will satisfy U.S. Army military specifications, as well as take advantage of the versatility of composite materials. A minimum weight design is first developed subject to satisfying the aerodynamic performance, strength, and autorotation constraints for all static load cases. The minimum weight design is then dynamically tuned to avoid resonant frequencies occurring at the design rotor speed. With this methodology, three rotor blade designs were developed based on the geometry of the UH-60A Black Hawk titanium-spar rotor blade. The first design is of a single titanium-spar cross section, which is compared with the UH-60A Black Hawk rotor blade. The second and third designs use single and multiple graphite/epoxy-spar cross sections. These are compared with the titanium-spar design to demonstrate weight savings from use of this design methodology in conjunction with advanced composite materials. Author

N87-25436# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
EFFECTS OF IMPACT LOADING ON CARBON FIBER REINFORCED STRUCTURES [AUSWIRKUNGEN VON SCHLAGBEANSPRUCHUNGEN AUF CFX-STRUKTUREN]
J. Bauer and J. Warnecke 1986 5 p In GERMAN Presented at DGLR-Jahrestagung, Munich, West Germany, 9-10 Oct. 1986
(MBB-Z-83/86; ETN-87-99975) Avail: Issuing Activity

The effects of impact loading on carbon fiber reinforced plastics aircraft structures were investigated. Structures which are damage-tolerant and light can only be realized if possible impact loading is already taken into account during the construction and the static design. This requires an estimate of the impact energy and suitable comparative values for the dimensioning criterium (acceptable fiber extension). Another possibility of a damage-tolerant construction is the optimization of the laminate via the stacking sequence. ESA

N87-25437*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
BEARING-BYPASS LOADING ON BOLTED COMPOSITE JOINTS
J. H. Crews, Jr. and R. A. Naik May 1987 34 p
(NASA-TM-89153; NAS 1.15:89153) Avail: NTIS HC A03/MF A01 CSCL 11D

The effects of simultaneous bearing and bypass loading on a graphite-epoxy (T300/5208) laminate were investigated. Onset damage and ultimate strengths were determined for each test case. A finite element stress analysis was conducted for each test case. The computed local stresses were used with appropriate failure criteria to analyze the observed failure modes and strengths. An unexpected interaction of the effect of the bypass and bearing loads was found for the onset of compression reacted bearing damage. The interaction was caused by a decrease in the bolt-hole contact arc and a corresponding increase in the severity of the bearing loads. The amount of bolt-hole contact had a significant effect on local stresses and, thus, on the calculated damage-onset and ultimate strengths. An offset-compression failure mode was identified for laminate failure under compression bearing-bypass loading. Author

N87-25438*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE EFFECTS OF CRUSHING SPEED ON THE ENERGY-ABSORPTION CAPABILITY OF COMPOSITE MATERIAL
Gary L. Farley Mar. 1987 23 p Prepared in cooperation with Army Aviation Research and Development Command, Hampton, Va.
(NASA-TM-89122; NAS 1.15:89122; AVSCOM-TR-87-B-1) Avail: NTIS HC A02/MF A01 CSCL 11D

The energy-absorption capability as a function of crushing speed was determined for Thornel 300/Fiberite 934 (Gr/E) and Kevlar-49/Fiberite 934 (K/E) composite material. Circular cross section tube specimens were crushed at quasi-static, 6 m/sec, and 12 m/sec speeds. Ply orientations of the tube specimens were (0/+ or - theta) sub 2 and (+ or - theta) sub 3 where theta=15, 45, and 75 degress. Based on the results of these tests the energy-absortion capability of Gr/E and K/E was determined to be a function of crushing speed. The crushing modes based on exterior appearance of the crushed tubes were unchanged for either material. However, the interlaminar crushing behavior changed with crushing speed. Author

N87-25439*# Lockheed-California Co., Burbank.
FLIGHT SERVICE EVALUATION OF ADVANCED COMPOSITE AILERONS ON THE L-1011 TRANSPORT AIRCRAFT Annual Flight Service Report No. 5
R. H. Stone Jun. 1987 14 p
(Contract NAS1-15069)
(NASA-CR-178321; NAS 1.26:178321) Avail: NTIS HC A02/MF A01 CSCL 11D

This report covers flight service evaluation of composite inboard ailerons on the L-1011 under contract NAS1-15069 for a period of five years. This is the fifth and final annual report of the maintenance evaluation program, and covers the period from July 1986 when the fourth yearly inspections were completed, through May 1987. Four shipsets of graphite/epoxy composite inboard ailerons were installed on L-1011 aircraft for this maintenance evaluation program. These include two Delta and two TWA aircraft. A fifth shipset of composite ailerons was installed in 1980 on Lockheed's flight test L-1011. The previous four annual inspections had been visual exterior inspections only. For this final inspection, the lower covers were removed for access and both interior and exterior surfaces, spars and ribs, and fastener holes were inspected. No damage or defects were observed on any of the composite ailerons, and no maintenance actions had occurred except for repainting of areas with paint loss. Flight hours on the airline components at the time of inspection ranged from 14,597 to 17,180 hours, after approximately 5 years of service. Author

N87-25988# Idaho Univ., Moscow. Dept. of Mechanical Engineering.
DYNAMIC MECHANICAL PROPERTIES OF ADVANCED COMPOSITE MATERIALS AND STRUCTURES: A REVIEW
R. F. Gibson *In* Vibration Inst., The Shock and Vibration Digest,

Volume 19, No. 7 Jul. 1987 p 13-22 (For primary document see N87-25986 19-99)
Avail: NTIS HC A05/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

N87-25440 ESDU International Ltd., London (England).
VAPOUR PRESSURES AND CRITICAL POINTS OF LIQUIDS. PART 3B: ADDITIONAL ALKYL- AND ALKENYLBENZENES
Nov. 1986 42 p
(ESDU-86027-Pt-3B; ISBN-0-85679-579-8; ISSN-0141-4062)
Avail: ESDU

This Data Item gives vapor pressure data for 17 C(11) to C(21) alkylbenzenes and 12 C(8) to C(12) alkylbenzes (styrenes). The data were obtained by a method described in ESDU 84021 involving a critical evaluation of experimental results in the literature, extrapolated by a recent reliable method into the low pressure region, and fitted by a Wagner equation applying over the full liquid range from the freezing to the critical point. The coefficients for the equation are given for each compound and three tables of vapor pressure are included: in SI units at 5 K intervals, in atmospheres at 5 C intervals, and in lbf/sq inch at 10 F intervals. The sources of the data used are listed and a table gives likely uncertainties in values predicted by the equation that should be allowed for in any critical situation. ESDU

N87-25441# Rutgers - The State Univ., Piscataway, N. J. Dept. of Mechanical and Aerospace Engineering.
AN ANALYTICAL METHOD OF NON-GRAYTHREE-DIMENSIONAL RADIATION HEAT TRANSFER IN SPRAY COMBUSTION
S. L. Chang and K. T. Rhee 1986 10 p
(Contract DAAG29-83-K-0042)
(AD-A179944; ARO-19869.11-EG) Avail: NTIS HC A02/MF A01 CSCL 21B

A computational study of radiation heat transfer in a combustor having fuel spray combustion is reported in the present paper. When the distribution of radiatively participating species is known in either a normal distribution or an exponential distribution in any direction of cylindrical coordinates with respect to a referenced location, e.g., in a form, F = f exp (-a rho - b phi squared - cz squared), where f, a, b, and c are distribution constants for individual species, the governing equation of radiation heat transfer without scattering in such a system can be solved with relative ease by using the herein reported method. Several results from the present author's work are explained that are employed for implementing the solution: a new coordinate transformation method to find the species distribution along individual optical paths centered at any chosen location in the combustor; a new formula for the adiabatic flame temperature in a logarithmic function facilitating solutions for various radiation equations; a new inverse error function enabling some exact solution of the governing equation of radiation heat transfer, etc. GRA

N87-25442# Brigham Young Univ., Provo, Utah. Dept. of Chemistry.
SUPERCRITICAL FLUID CHROMATOGRAPHY/SUPERSONIC JET SPECTROSCOPY Progress Report, 15 Dec. 1986 - 15 Mar. 1987
S. R. Goates and M. L. Lee 1987 6 p
(Contract DE-FG22-86PC-90534)
(DE87-009065; DOE/PC-90534/4) Avail: NTIS HC A02/MF A01

Successful linking of supercritical fluid chromatography (SFC) and supersonic jet (SJ) spectroscopy will require large but abrupt restriction without incorporating dead volumes in the nozzle which are effectively greater than a few nanoliters. Several nozzle designs are discussed. Pinhole nozzles still appear to offer the best type for direct supercritical fluid expansions, despite their problems with plugging. They would be especially suitable for packed column or even micro-bore SFC. We are pursuing an investigation of this nozzle type with regard to reducing problems with dead volume in the connection to the column. Several options exit for sheath nozzles which incorporate a secondary, monatomic gas expansion into which the SF/SJ is seeded. The first is the low pressure sheath flow nozzle which we have earlier described and have begun to evaluate. The main advantages to this design are that porous frit restrictors could be used to regulate the supercritical fluid flow rate, and that it may offer the best arrangement for pulsed operation. Roughly a thousand-fold enhancement in sensitivity could be expected if the SF/SJ could be pulsed synchronously with the probe laser, as is often done for gas-phase SJ. Pulsed nozzles typically are not capable of withstanding the high pressures and temperatures required with SFC and have the drawback that sudden pressure drops within the nozzle can lead to precipitation of the solute in the nozzle. Pulsing the secondary gas into the sheath region or pulsing the mixture out of the sheath nozzle would alleviate these problems. DOE

N87-25443*# Texas A&M Univ., College Station.
ELECTROCHEMICAL PROCESSING OF SOLID WASTE Semiannual Report, Jul. 1987
John OM. Bockris Jul. 1987 48 p
(Grant NAG-192)
(NASA-CR-181128; NAS 1.26:181128) Avail: NTIS HC A03/MF A01 CSCL 07D

An investigation of electrochemical waste treatment methods suitable for closed, or partially closed, life support systems for manned space exploration is discussed. The technique being investigated involves the electrolysis of solid waste where the aim is to upgrade waste material (mainly fecal waste) to generate gases that can be recycled in a space station or planetary space environment. Author

N87-25444# EIC, Inc., Norwood, Mass.
SPATIALLY SELECTIVE PHOTOELECTROCHEMISTRY Final Report, 1 Aug. 1979 - 31 Oct. 1986
R. D. Rauh, Robert A. Boudreau, Michael M. Carrabba, Margaret E. Langmuir, and Ronald H. Micheels Mar. 1987 7 p
(Contract N00014-79-C-0700)
(AD-A180186; TR-13) Avail: NTIS HC A02/MF A01 CSCL 20L

This program has dealt with applications of photoelectrochemistry to semiconductor technology. Light localized etching and electroplating have been demonstrated for n-GaAs, including imaging with a computer-controlled focused laser light source and crystallographically enhanced photoelectrochemical etching using conventional photoresist masks. These studies have resulted in new processes for high aspect ratio etching in compound semiconductors, and in fabrication of sawtooth Eschelle-type diffraction gratings for spectroscopy and integrated electro-optics. GRA

N87-25445# California Univ., Berkeley. Dept. of Chemistry.
PICOSECOND STUDIES OF CONDENSED-PHASE ENERGETIC MATERIALS Final Report, 14 Mar. 1982 - 14 Mar. 1985
John H. Clark 21 Jan. 1987 532 p
(Contract N00014-82-K-0349)
(AD-A180310) Avail: NTIS HC A23/MF A01 CSCL 19A

Described is a series of picosecond spectroscopic investigations aimed at studying the reaction dynamics of condensed phase energetic materials. The emphasis of the experimental work focussed on rotational reorientation of excited state molecules in solution. A number of results of relevance to the understanding of condensed phase energetic materials were obtained. Studies were made at elevated pressures (up to 10kbar). The short time behavior of molecules under such conditions may be relevant to shock wave chemistry, and therefore, to energetic materials. The rotational behavior of molecules under these and

other conditions were observed and compared with a variety of theoretical approaches. It was found that hydrodynamic models, which are fundamentally macroscopic in character, could be used to describe the short-time behavior of molecules. It was found that on this time scale, dielectric relaxation plays an important role in determining behavior of polar molecules. It was also observed that the molecular rotation times were independent of the excitation frequency. This was used to estimate the microscopic thermal conductivity of the solvent. Since the emission spectra are not observed to change with excitation energy, the excess vibrational energy in the molecule must be dissipated into the solvent in a few picoseconds. Once there, this heat might be expected to decrease the solvent viscosity. GRA

N87-25446# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
GAS CHROMATOGRAPH-BASED SYSTEM FOR MEASURING THE METHANE FRACTION OF DIESEL ENGINE HYDROCARBON EMISSIONS
J. S. Hoffman, S. M. Geyer, S. S. Lestz, and F. M. Black Mar. 1987 32 p Sponsored by EPA, Research Triangle Park, N.C.
(PB87-174850; EPA-600/D-87-097) Avail: NTIS HC A03/MF A01 CSCL 07D

The methane analytical system was developed to enable diesel methane emissions to be qualified separately from total unburned hydrocarbon emissions. The instrument employed gas chromatographic principles whereby a molecular sieve column operating isothermally separated methane from the nonmethane hydrocarbons. GRA

N87-25447*# Alabama Univ., Huntsville. Dept. of Chemistry.
SURFACE INTERACTION MECHANISMS OF 5eV ATOMIC OXYGEN: DATA ANALYSIS FROM THE UAH EXPERIMENT ON STS-8 Final Report
J. C. Gregory 31 Jul. 1987 23 p
(Grant NAGw-823)
(NASA-CR-181141; NAS 1.26:181141) Avail: NTIS HC A02/MF A01 CSCL 07D

The University of Alabama in Huntsville (UAH) experiment which flew on the STS-8 mission had several objectives which were mostly of a speculative nature since so little was known of the processes of interest. The experiment provided original, if limited, data on: (1) oxidation of metal surfaces, (2) reaction rates of atomic oxygen with carbon and other surfaces and the dependence of these rates on temperature, and (3) the angular distribution of 5eV atoms scattered off a solid surface. Provided is a review of the results, with reference given to fuller published accounts where these are available. Author

N87-25746# Joint Publications Research Service, Arlington, Va.
THERMODYNAMIC STATE OF MULTICONSTITUENT CO2=CO=H2O=H2=N2 GAS MIXTURE IN ELECTROLYZER WITH SOLID ELECTROLYTE
B. G. Grishayenkov and N. G. Zorina *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 75-80 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, Jan. - Feb. 1987 p 55-58 (For primary document see N87-25734 19-52)
Copyright Avail: NTIS HC A08/MF A01

N87-25886*# LeTourneau Coll., Longview, Tex. Dept. of Chemistry.
NON-EQUILIBRIUM EFFECTS IN HIGH TEMPERATURE CHEMICAL REACTIONS
Richard E. Johnson *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer FAculty Fellowship Program, 1986, Volume 2 Jun. 1987 18 p (For primary document see Summer FAculty Fellowship Program, 1986, Volume 2 18 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 07D

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N87-25448# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Werkstofftechnologie.
CORRELATION BETWEEN MICROSTRUCTURE AND FATIGUE CRACK PROPAGATION IN A COPPER-NICKEL-CHROMIUM ALLOY
J. Heerens, B. Jiang, R. Wagner, and K.-H. Schwalbe 1986 64 p In GERMAN; ENGLISH summary
(GKSS-86/E/46; ISSN-0344-9629; ETN-87-99658) Copyright Avail: NTIS HC A04/MF A01

The influence of the microstructure on fatigue crack propagation in a spinodally decomposed Cu-32.2 wt% Mi-3.6 wt% Cr alloy was investigated. The fatigue crack propagation was determined in an argon atmosphere for four decomposition structures by measuring the crack propagation rate versus the increase in stress intensity. The results show a significant influence of the decomposition structure on fatigue crack propagation. For the determination of the slip distribution ahead of the crack tip, fractographic investigations of the fracture surface, and transmission electron-microscopic investigations of the plastic zone were conducted. Correlations between slip distribution and fatigue crack propagation were considered. ESA

N87-25449 British Aerospace Aircraft Group, Woodford (England). Structures Dept.
ASSESSMENT OF THE ACCEPTABILITY OF THE INDIRECT EXTRUSION PROCESS FOR THE PRODUCTION OF ALUMINIUM ALLOY EXTRUSIONS
H. J. Price May 1986 22 p
(Contracts MOD(PE)-A2a/408; MOD(PE)-A93B/2084)
(BAe-MSM-R-GEN-0632; BR99842; ETN-87-99825) Copyright Avail: Issuing Activity

Cut up tests were performed on 2 indirect extrusions of the aluminum alloys 7150 and 2024. Longitudinal tensile and compression tests, transverse tensile tests, fracture toughness evaluations, and stress corrosion trials were included. The extrusions produced are entirely satisfactory. The consistency of properties observed throughout the length of each extrusion and the freedom from peripheral coarse grain are noted. ESA

N87-25450# Naval Research Lab., Washington, D. C.
ION BEAM PROCESSING Final Report
G. K. Hubler 13 Mar. 1987 82 p
(AD-A179880; NRL-MR-5928) Avail: NTIS HC A05/MF A01 CSCL 11F

This memo introduces ion implantation processing. The introduction and background sections present applications that might be considered for ion implantation processing and give a brief description of the apparatus and the physical principles underlying the techniques. The entire process of ion beam processing is described to allow the reader to plan treatment parameters for parts and/or to double check treatment parameters recommended by vendors. This document provide workers in the field with a handbook of tables, graphs and equations that are needed for doing ion implantation processing. These include tables of ion ranges and straggling, formulae and tables which allow estimates to be simply made for sputtering coefficients, depth profiles of implanted elements, damage profiles, dose for sputter saturation of implanted profiles, temperatures reached by parts in vacuum during implantation, and estimates of the time and cost of ion implantation. processing; Applications of ion implantation; Wear; Straggling; Alloy formation; Tribology. GRA

N87-25451# Pennsylvania State Univ., University Park. Dept. of Materials Science and Engineering.
HIGH TEMPERATURE OXIDATION AND ELECTROCHEMICAL STUDIES RELATED TO HOT CORROSION Annual Technical Report
G. Simkovich Apr. 1987 38 p
(Contract N00014-86-K-0133)
(AD-A179891) Avail: NTIS HC A03/MF A01 CSCL 07D

(Contract N00014-86-K-0133)
(AD-A179891) Avail: NTIS HC A03/MF A01 CSCL 07D

This report describes the 1st years efforts upon a number of processes related to hot corrosion. Total conductivities of pure sodium sulfate, Na2SO4 doped with nickel oxide and Na2SO4 doped with ferric oxide were measured at 900 C as a function of the activity of sodium monoxide. Partial electronic conductivities were also measured for the same systems utilizing the Wagner-Hebb type polarization cell. It was found that the total D.C. conductivity of pure Na2SO4 was of the order of .05 (1/cc) and varied only slightly with changes in the activity of Na2O.

GRA

N87-25452# California Univ., Berkeley. Dept. of Materials Science and Mineral Engineering.

CONTROL OF CRYOGENIC INTERGRANULAR FRACTURE IN HIGH-MANGANESE AUSTENITIC STEELS Ph.D. Thesis

M. J. Strum Dec. 1986 130 p
(Contract DE-AC03-76SF-00098)
(DE87-008226; LBL-22650) Avail: NTIS HC A07/MF A01

The sources of cryogenic intergranular embrittlement in high-Mn austenitic steels and the conditions necessary for its control are examined. It is shown that the high-Mn alloys are inherently susceptible to intergranular embrittlement due to both their low grain boundary cohesion and heterogeneous deformation characteristics. Extrinsic sources of embrittlement which could account for the transition behavior are not observed. An Auger electron spectroscopy (AES) study shows no indication of impurity-segregation-induced embrittlement. No grain boundary precipitation is observed, and austenite stabilization does not ensure ductile fracture. The influence of chemistry modifications on the ductile-to-brittle transition behavior were also examined through additions of N, Cr, and C to binary Fe-31 Mn. Nitrogen additions increase the 77K yield strength at a rate of 2200 MPa per weight percent N, and increase the austenite stability, but also increase the susceptibility of ternary alloys to intergranular fracture. Quaternary Cr additions are effective in increasing the N solubility, and lower the transition temperature. Carbon additions result in complete suppression of intergranular fracture at 77K. Qualitatively significant changes in the deformation heterogeneity with chemistry modifications are not observed. The temper-toughening of Fe-Mn-Cr-N alloys is associated with the grain boundary segregation of boron and the redistribution of N. Both boron and carbon are expected to inhibit intergranular fracture through increases in grain boundary cohesion. DOE

N87-25453# Mound Lab., Miamisburg, Ohio.

BONDING AND FRACTURE OF TITANIUM-CONTAINING BRAZE ALLOYS TO ALUMINA

R. T. Cassidy, R. E. Pence, W. E. Moddeman, and A. D. Buonaquisti 1987 39 p Presented at the 89th Annual Meeting of the American Ceramic Society, Pittsburgh, Pa., 26 Apr. 1987 Prepared in cooperation with JEOL, USA, Inc., Peabody, Mass.
(Contract DE-AC04-76DP-00053)
(DE87-009195; MLM-3431(OP); CONF-870422-1) Avail: NTIS HC A03

Titanium-containing braze alloys were used to join both 94 and 99+% Al2O3 compositions. Resulting tensile strengths of 11 to 16 KSI compared favorably with conventional Mo-Mn metallizing. Extensive optical, scanning, WDX, and Auger analyses reveal the migration of titanium to the ceramic surface during brazing where it reacts with the copper of the braze alloy and forms an intermetallic of the approximate composition Cu(sub x)Ti (1.2 less than x less than 1.6). The presence of oxidized titanium, probably TiO2, was also detected near the interface. Examination of fractured samples indicates that fracture is occurring in the CaO.SiO2 glassy phase of the ceramic very near the braze layer. DOE

N87-25454# State Univ. of New York, Stony Brook.

THEORETICAL STUDIES OF CHEMISORPTION ON COPPER NICKEL ALLOYS AND SURFACE EMBRITTLEMENT Progress Report, 14 Jun. 1986 - 15 Jun. 1987

J. L. Whitten 27 Jan. 1987 14 p
(Contract DE-FG02-84ER-45100)
(DE87-009863; DOE/ER-45100/3) Avail: NTIS HC A02/MF A01

An embedding theory for treating chemisorption on metals is being developed and applied to systems involving titanium, copper, nickel and copper/nickel alloy substrates, and H2, H, CO, C and coabsorbed H and C. The nickel-hydrocarbon fragment project was started this year and preliminary results are reported. The main emphasis of the work is on the energetics of adsorption as a function of surface site and composition, and the reactivity of adsorbed species. The project on the effect of hydrogen on the strength of titanium surface bonds was completed during this period. This work relates to energetics affecting surface embrittlement on adsorption. Studies of the ground and excited states of a nickel surface atom embedded in a nickel lattice modelled as a 49 atom cluster were completed. The energetics of the d sup 9, d sup 10, and the d sup 8 s sup 2 states are determined, and these states and a manifold of closely spaced electronic states are analyzed. Other work involves preliminary studies of Auger processes associated with SiF and SiO bonds and the effect of bonding on the reconstruction of the Si (111) surface. Localization investigations have suggested a new way tp proceed with the embedding formalism that promises more rapid convergence and computational simplification. Theoretical work during this period has also focused on the representation of fields acting on the embedded subspace. DOE

N87-25455* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

OXYGEN DIFFUSION BARRIER COATING Patent

Jalaiah Unnam, inventor (to NASA) (Analytical Services and Materials, Inc., Tabb, Va.) and Ronald K. Clark, inventor (to NASA) 21 Jul. 1987 8 p Filed 18 Mar. 1986 Supersedes N86-24814 (24 - 15, p 2435)
(NASA-Case-LAR-13474-1-SB; US-Patent-4,681-818; US-Patent-Appl-SN-840900; US-Patent-Class-428-607; US-Patent-Class-428-632; US-Patent-Class-428-651; US-Patent-Class-428-660; US-Patent-Class-148-6.3; US-Patent-Class-204-192.15; US-Patent-Class-204-192.23) Avail: US Patent and Trademark Office CSCL 11F

A method for coating a titanium panel or foil with aluminum and amorphous silicon to provide an oxygen barrier abrogating oxidation of the substrate metal is developed. The process is accomplished with known inexpensive procedures common in materials research laboratories, i.e., electron beam deposition and sputtering. The procedures are conductive to treating foil gage titanium and result in submicron layers which virtually add no weight to the titanium. There are no costly heating steps. The coatings blend with the substrate titanium until separate mechanical properties are subsumed by those of the substrate without cracking or spallation. This method appreciably increases the ability of titanium to mechanically perform in high thermal environments such as those witnessed on structures of space vehicles during re-entry.

Official Gazette of the U.S. Patent and Trademark Office

N87-25456*# Illinois Univ., Urbana-Champaign.

A STUDY OF REDUCED CHROMIUM CONTENT IN A NICKEL-BASE SUPERALLOY VIA ELEMENT SUBSTITUTION AND RAPID SOLIDIFICATION PROCESSING Ph.D. Thesis Final Report

William O. Powers May 1987 288 p
(Grant NAG3-325)
(NASA-CR-179631; NAS 1.26:179631) Avail: NTIS HC A13/MF A01 CSCL 11F

A study of reduced chromium content in a nickel base superalloy via element substitution and rapid solidification processing was performed. The two elements used as partial substitutes for chromium were Si and Zr. The microstructure of conventionally solidified materials was characterized using microscopy techniques. These alloys were rapidly solidified using the chill block melt spinning technique and the rapidly solidified microstructures were characterized using electron microscopy. The spinning technique

and the rapidly solidified microstructures was assessed following heat treatments at 1033 and 1272 K. Rapidly solidified material of three alloys was reduced to particulate form and consolidated using hot isostatic pressing (HIP). The consolidated materials were also characterized using microscopy techniques. In order to evaluate the relative strengths of the consolidated alloys, compression tests were performed at room temperature and 1033 K on samples of as-HIPed and HIPed plus solution treated material. Yield strength, porosity, and oxidation resistance characteristics are given and compared. Author

N87-25457# Brown Univ., Providence, R. I. Div. of Engineering.
CORRELATIONS OF MICROSTRUCTURE WITH DYNAMIC AND QUASI-STATIC FRACTURE IN A PLAIN CARBON STEEL
H. Couque, R. J. Asaro, J. Duffy, and S. H. Lee Feb. 1987 94 p
(Contract DAAG29-85-K-0003)
(AD-A180420; TR-5; ARO-22306.9-EG) Avail: NTIS HC A05/MF A01 CSCL 11F

An investigation was conducted into the effects of temperature, loading rate, and various microstructural parameters on the initiation of plane strain fracture of a plain carbon AISI 1020 steel. Ferrite and prior austenite grain size were chosen as the principal microstructural features to be investigated. The microstructural variations were accomplished by changing austenitizing temperature and by altering cooling rates during normalization. GRA

N87-25458# Carnegie-Mellon Univ., Pittsburgh, Pa.
STUDIES OF MATERIALS HAVING SIGNIFICANCE FOR THE PRODUCTION OF HIGH ENERGY MAGNETS Final Report, 1 Feb. 1984 - 31 Jan. 1987
W. E. Wallace 3 Apr. 1987 12 p
(Contract DAAG29-84-K-0040)
(AD-A180553; ARO-20665.1-MS) Avail: NTIS HC A02/MF A01 CSCL 20C

Magnetic properties, saturation magnetizations, Curie temperatures and anisotropy fields of a number of rare earth-transition metal systems are reported. Systems studied fall into five categories: (1) 1:5 and 2:17 compounds, (2) R2T14B, where R is rare earth and T is a 3d transition metal, (3) borides related to R2Fe14B, (4) intermetallic hydrides, and (5) miscellaneous alloys. The work has revealed a number of interesting features of these systems: (1) when R in RCo5 systems is partially replaced by Ti, Zr or Hf, T sub c is sharply incremented; (2) PrCo8Fe9 has a theoretical (BH) sub max of 68 MGOe; (3) the R2T14B systems exhibit the same magnetic coupling systematics as the binary RT sub x systems; (4) the R2Fe14B systems exhibit the same magnetic coupling systematic structures - conical, axial and planar anisotropy; (5) the RCo4B systems have small or negative anisotrophy and hence are unsuitable for magnetic fabrication; and (6) hydrogenation weakens the uniaxial anisotropy in R2Fe14B systems. GRA

N87-25459*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OBSERVATIONS OF DIRECTIONAL GAMMA PRIME COARSENING DURING ENGINE OPERATION
Susan L. Draper, David R. Hull, and Robert L. Dreshfield Feb. 1987 11 p Presented at the TMS Annual Meeting, Denver, Colo., 23-26 Feb. 1987; sponsored by AIME
(NASA-TM-100105; E-3642; NAS 1.15:100105) Avail: NTIS HC A02/MF A01 CSCL 11F

Two alloys with negative mismatch parameters, NASAIR 100 and a modified NASAIR 100 called Alloy 3 were run as turbine blades in an experimental ground based Garret TFE731 engine for up to 200 hr. The directional coarsening of gamma prime (rafting) that developed during engine testing was analyzed and compared to previous research from laboratory tests. The blades were found to be rafted normal to the centrifugal stress axis over much of the span, but near the surfaces, the blades were found to be rafted parallel to the centrifugal stress axis for certain cycles. Representative photomicrographs of the blades and the effects of stress and temperature on raft formation are shown. Author

N87-25460# Technische Univ., Munich (West Germany). Inst. fuer Werkstoff- und Verarbeitungswissenschaften.
THE EFFECT OF IMPURITIES IN THE SOFT SOLDER BATH ON SOLDER BATH, SOLDERING PROCESS, AND SOLDERED CONNECTION Ph.D. Thesis [EINFLUSS VON VERUNREINIGUNGEN IM WEICHLOTBAD AUF LOTBAD, LOETPROZESS UND LOETVERBINDUNG]
Heribert M. Zahel 1985 160 p In GERMAN
(ETN-87-99345) Avail: NTIS HC A08

The changes in solder bath, soldering process, and soldered connection due to a defined doping with single impurities of pure soldering materials, under constant test conditions were investigated in order to obtain quantitative relations concerning the effects on quality-determining properties. The soldering materials and test conditions were chosen to be relevant for the electronics industry. It is found that impurity distribution in a static bath is not homogeneous, that the effect on the interfacial surface energies solder/substrate and solder/soldering flux changes the wetting behavior, and that the effect on the soldering connection manifests itself mainly in the intermetallic connection layer. Impurities which form oxides with the soldering bath components have the most harmful effects. Impurities which form mixed crystals cause the smallest effects; impurities which form intermetallic phases are in between. In the presence of several impurity elements, interactions occur. ESA

N87-25461*# National Aeronautics and Space Administration, Washington, D.C.
INVAR AND ELINVAR TYPE AMORPHOUS Fe-Cr-B ALLOYS WITH HIGH CORROSION RESISTANCE
M. Kikuci, K. Fukamichi, and T. Masumoto Jul. 1987 20 p Transl. into ENGLISH from Nippon Kinzoku Gakkaishi (Japan), v. 43, no. 10, 1979 p 885-890 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TT-20052; NAS 1.77:20052) Avail: NTIS HC A02/MF A01 CSCL 11F

Amorphous (Fe(1-x)Cr(x))85B15 alloys (x = 0 to 0.15) were prepared from the melts by rapid quenching using a single roller techinque, and their Invar and Elinvar characteristics and corrosion resistance were investigated. With an increase in chromium content the Curie temperature and the saturation magnetic moment per iron atom decreased monotonically, while the crystallization temperature incresed gradually. The thermal expansion coefficient alpha around room temperature became slightly larger with increasing chromium content. Nevertheless, these amorphous alloys exhibited excellent Invar characteristics below the Curie temperature. The value of Young's modulus increased remarkably in a relatively low magnetic field and then saturated at a field of about 80 kA/m, showing a large delta E effect. Its value as well as a longitudinal linear magnetostriction became smaller with an increase in chromium content. The temperature coefficient of Young's modulus changed from postive to negative, and the temperature range showing the Elinvar characteristics became narrower with chromium content. The temperature coefficient of delay time determined from the values of alpha and e was very small. The corrosion resistance of these alloys was extremely improved by chromium addition. Author

N87-25462*# National Aeronautics and Space Administration, Washington, D.C.
GROWTH PROCESS OF GAMMA'-PARTICLES IN A LIQUID-QUENCHED Ni-15 AT PERCENT Al ALLOY
A. Tachikake, T. Suzuki, Y. Nishi, and E. Yajima Jul. 1987 19 p Transl. into ENGLISH from Japan Institute of Metals Journal (Japan), v. 49, no. 10, Oct. 1985 p 818-824 Original language document was announced in IAA as A86-31201 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TT-20009; NAS 1.77:20009; ISSN-0021-4876) Avail: NTIS HC A02/MF A01 CSCL 11F

(NASA-TT-20009; NAS 1.77:20009; ISSN-0021-4876) Avail: NTIS HC A02/MF A01 CSCL 11F

The growth of gamma-prime particles in a supersaturated Ni-15 at% Al alloy prepared by the liquid-quench method was studied using a magnetic mass balance, transmission electron microscopy, and field ion microscopy. Three stages in the precipitation and growth of these particles are demonstrated. In the first phase, the gamma-prime phase was produced by nucleation of spinodal decomposition of the alloy. In the second stage, spherical gamma-prime particles were arranged at random in the matrix with the size independent of aging time. Then, the Al concentration in the matrix decreased with the -1/3 power of the aging time. These results suggest that the degree of ordering increases with aging time. In the third stage, the particles were coarsened with aging time. They were arranged in the matrix (100) zone and were cubic, with the cube face lying on (100). The interfacial free energy was 28.4 mJ/sq m at 873 K and 22.4 mJ/sq m at 973 K. Author

N87-25463*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

HYDROGEN TRAPPING AND THE INTERACTION OF HYDROGEN WITH METALS

Merlin D. Danford Jul. 1987 36 p
(NASA-TP-2744; NAS 1.60:2744) Avail: NTIS HC A03/MF A01 CSCL 11F

A method has been developed for the determination of trapped hydrogen in metal alloys, involving the determination of mobile hydrogen using the electrochemical method and the determination of total hydrogen with the fusion method, the difference in hydrogen concentrations being due to trapped hydrogen. It has been found that hydrogen enters body-centered cubic structures through the grain bodies rather than through the grain boundaries. Hydrogen also diffuses much more rapidly in body-centered cubic structures on charging than in face-centered cubic structures, the hydrogen distribution being more uniform in nature. The energy necessary to cause hydrogen embrittlement is postulated to arise from the changes in crystal lattice energies brought about through interaction of hydrogen with atoms in the metal lattice. The total energy change is more negative for body-centered cubic structures, believed to be the cause of a greater tendency toward hydrogen embrittlement. Finally, the agreement of hydrogen concentrations obtained at 25 C by the electrochemical method with those obtained by the fusion method are taken as a strong indication of the power and validity of the electrochemical method. Author

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials*.

N87-25464# Hoechst CeramTec A.G., Marktredwitz (West Germany). Bereich Gehaueuse und Metallisierte Substrate.

CERAMIC, SINGLE AND MULTILAYER SUBSTRATES FOR INTEGRATED CIRCUITS Final Report, Jul. 1985

Juergen Brandenburger Bonn, West Germany BMFT Dec. 1986 49 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-T-86-099; ISSN-0340-7608; ETN-87-99697) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 10

A 20/25 mil chip carrier with a multilayer structure was developed and tested in order to fulfill demands for further reduction of geometry for packaging. The production procedure for packages was further developed in order to decrease the geometry and simultaneously improve tolerances especially with regard to the production steps punching, screen printing, and indenting. Ceramic films were developed and optimized. After achieving the targets for the single production steps, the functionality of the packages was proven. Successful tests on 25 mil chip carriers as well as on a pin grid array 144 were carried out. ESA

N87-25465# Honeywell, Inc., Bloomington, Minn. Physical Sciences Center.

SYNTHESIS OF CONJUGATED POLYMERS VIA POLYMER ELIMINATION REACTIONS

Samson A. Jenekhe 16 Apr. 1987 28 p
(Contract N00014-84-C-0699)
(AD-A180058; TR-4) Avail: NTIS HC A03/MF A01 CSCL 07C

The transformation of nonconjugated polymers into conjugated polymers using elimination reactions is described. Heterocyclic conjugated polymers containing alternating aromatic and quinonoid sections in the main chain are synthesized by chemical or electrochemical redox elimination reaction on soluble precursor polymers containing sp3 carbon atom bridges between the aromatic heterocyclic units. Progress of the redox elimination process is followed by infrared and electronic spectra as well as by cyclic voltammetry. A reaction mechanism in which the precursor polymer undergoes a redox reaction followed by loss of the bridge hydrogens is proposed. The resulting conjugated aromatic/quinonoid polymers generally have very small semiconductor band gaps in accord with predictions of recent theoretical calculations. A brief view of related syntheses of conjugated polymers from nonconjugated precursor polymers is also given. GRA

N87-25466# State Univ. of New York, Buffalo. Dept. of Chemistry.

INORGANIC POLYMERS AND THE ELIMINATION-CONDENSATION REACTION Final Report, 1 Jul. 1978 - 28 Feb. 1987

1978 - 28 Feb. 1987

O. T. Beachley, Jr. 29 Apr. 1987 53 p
(Contract N00014-78-C-0562)
(AD-A180089) Avail: NTIS HC A04/MF A01 CSCL 07C

During the course of our research a number of new organo-aluminum, - gallium and -indium compounds have been prepared and fully characterized by elemental analyses, cryoscopic molecular weight measurements, physical properties, chemical properties, infrared and NMR spectroscopy as well as X-ray structural studies. In addition, the kinetics and mechanism of the elimination-condensation reaction, a reaction of fundamental significance to the chemistry of group 13-15 compounds, have been eludicated for several pairs of aluminum-nitrogen and -phosphorus compounds semiconductor materials. Our synthetic studies have provided a variety of new types of compounds as well as new compounds of significance to the formation of semiconductor materials by organo molecular crystal vapor disposition and potentially by liquid crystal vaporization. GRA

N87-25467# California Univ., Berkeley. Lawrence Berkeley Lab.

STUDIES OF MONOMER AND POLYMER MONOLAYERS USING OPTICAL SECOND AND THIRD HARMONIC GENERATION

G. Berkovic and Y. R. Shen Apr. 1987 14 p Presented at the 193rd National Meeting of the American Chemical Society, Denver, Colo., 5 Apr. 1987
(Contract DE-AC03-76SF-00098)
(DE87-009622; LBL-23267; CONF-870410-22) Avail: NTIS HC A02/MF A01

Optical second harmonic generation (SHG) is a highly surface sensitive technique for studying ultrathin molecular layers. This technique has been used to study monolayers of various organic monomers - vinyl stearate, octadecyl methacrylate and some diacetylene derivatives - and their corresponding polymers spread at air/water interfaces. Different SHG signals are obtained from a pure water surface, and from water covered with monomer and polymer monolayers. During polymerization of monomer monolayers the SHG signal intensity is observed to change continuously from the monomer monolayer value to the polymer monolayer value. Monolayer polymerization of some amphiphilic diacetylenes was also studied by third harmonic generation (THG),

which unlike SHG is not a surface sensitive probe. However, the extremely high third order nonlinearity of polydiacetylenes enables THG from a single monolayer to be observable above the water background signal. In addition, evaluation of surface molecular orientations and molecular nonlinear optical coefficients from monolayer SHG and THG is also discussed. DOE

N87-25468# Garrett Turbine Engine Co., Phoenix, Ariz.
HIGH TEMPERATURE COATING STUDY TO REDUCE CONTACT STRESS DAMAGE OF CERAMICS Final Report
J. Schienle and J. Smyth Mar. 1987 105 p Prepared in cooperation with ORNL
(Contract DE-AC05-84OR-21400)
(DE87-009801; ORNL/Sub-84-47992/1) Avail: NTIS HC A06/MF A01

Si3N4 and SiC are susceptible to contact stress damage at ceramic component interfaces in gas turbine engines. An objective was to develop adherent coating compositions and procedures that will improve contact-stress damage resistance of Si3N4 and SiC. Yttria (Y2O3) stabilized zirconia (ZrO2) coatings were applied by electron beam-physical vapor deposition (EB-PVD) to three substrate materials: reaction bonded Si3N4 (RBSN), sintered Si3N4, and sintered SiC (SSC). Several controlled substrate pretreatments (both mechanical and chemical) were used to aid in obtaining a better understanding of the mechanisms of coating adherence. Each coating/substrate system was evaluated for coating adherence before and after oxidation exposure. The coating/substrate interfaces were evaluated for microstructural characteristics. Pretreatment and coating approaches projected to improve coating adherence were selected. Specimens were prepared to evaluate the coating adherence before and after oxidation exposure. The systems exhibiting the best coating adherence after oxidation exposure were identified. Additional specimens for each of these systems were prepared for analysis of the coating thermal spall resistance, friction, and contact damage resistance. The friction and contact damage resistance of uncoated RBSN, SSN, and SSC were also evaluated. DOE

N87-25469* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMINOPHENOXYCYCLOTRIPHOSPHAZENE CURED EPOXY RESINS AND THE COMPOSITES, LAMINATES, ADHESIVES AND STRUCTURES THEREOF Patent
Devendra Kumar, inventor (to NASA) (National Academy of Sciences - National Research Council, Washington, D. C.), George M. Fohlen, inventor (to NASA), and John A. Parker, inventor (to NASA) 26 May 1977 10 p Filed 21 Nov. 1985 Supersedes N85-21686 (24 - 12, p 1927)
(NASA-Case-ARC-11548-1; US-Patent-4,668,589; US-Patent-Appl-SN-806572; US-Patent-Class-428-417; US-Patent-Class-428-413; US-Patent-Class-528-108; US-Patent-Class-528-168) Avail: US Patent and Trademark Office CSCL 11B

Aminophenoxy cyclotriphosphazenes such as hexakis (4-aminophenoxy) cyclotriphosphazene and tris (4-aminophenoxy)-tris phenoxy cyclotriphosphazene are used as curing agents for epoxy resins. These 1,2-epoxy resins are selected from di- or polyepoxide containing organic moieties of the formula (CH2-CHO-CH2) m-W-R-W- (CH2CH-CH2O)m where R is diphenyl dimethylmethane, diphenylmethane; W is a nitrogen or oxygen atom; and m is 1 when W is oxygen and 2 when W is nitrogen. The resins are cured thermally in stages at between about 110 to 135 C for between about 1 and 10 min, then at between about 175 to 185 C for between 0.5 to 10 hr and post cured at between about 215 and 235 C for between 0.1 and 2 hr. These resins are useful for making fire resistant elevated temperature stable composites, laminates, molded parts, and adhesives and structures, usually for aircraft secondary structures and for spacecraft construction. NASA

N87-25470# Vanderbilt Univ., Nashville, Tenn. Dept. of Physics and Astronomy.
A USER'S GUIDE TO THE PICKER DIFFRACTOMETER FOR POLYMER MORPHOLOGY STUDIES Interim Report, 1980 - 1984
P. G. Lenhert, Joseph F. OBrien, and W. W. Adams Dec. 1986 47 p
(Contract F33615-82-C-5001)
(AD-A180217; AFWAL-TR-86-4024) Avail: NTIS HC A03/MF A01 CSCL 11B

The use of the Picker Automated Four-circle X-Ray Diffractometer System for polymer morphology studies is explained and illustrated. Operations of the instrument, selection of experimental parameters, and specific methods for the following analyses are presented: crystallite size, orientation factors (with resolved or overlapped reflections), layer line intensity scan, and full pole figures. GRA

N87-25471# Johns Hopkins Univ., Baltimore, Md. Dept. of Materials Science and Engineering.
PREPARATION, CHARACTERIZATION AND PROPERTIES OF RAPIDLY SOLIDIFIED ALLOYS Progress Report
L. Bendersky, D. Shechtman, and E. Horowitz Oct. 1986 114 p
(Contract N00014-85-K-0779; DARPA Order 5527)
(AD-A180318) Avail: NTIS HC A06/MF A01 CSCL 11F

The results obtained on six research projects undertaken within the framework of the DARPA/ONR sponsored research program on rapidly solidified alloys are reported in this progress report. Each of the six topics has been prepared in the form of manuscripts which have been submitted and/or accepted for publication in a scientific journal. The manuscripts deal with microstructure niobium/silicon alloys, phase relationships of icosahedral alloys (aluminum/manganese alloys), microsegregation (silver/copper alloys), crystallization of the icosahedral phase (aluminum/manganese alloys), x-ray and electron studies of quasicrystals (Al-Mn-Si alloys), and phase equilibria studies (Al-Mn alloys). This research has contributed important data and concepts dealing with rapidly solidified alloy systems. GRA

N87-25472# Naval Surface Weapons Center, Silver Spring, Md.
SYNTHESIS OF ENERGETIC SINGLE PHASE AND MULTI-PHASE POLYMERS Annual Progress Report, 1 Jan. - 31 Dec. 1986
H. G. Adolph, J. M. Goldwasser, and D. A. Cichra 31 Mar. 1987 43 p
(AD-A180552) Avail: NTIS HC A03/MF A01 CSCL 07C

Investigation of the synthesis of polyformals from nitro- and fluorodiols was continued. Factors affecting the molecular weight distribution of hexafluoropentanediol and 2-tri-fluoromethyl-3-oxaheptafluoroheptanediol polyformals were determined. In the polycondensation of 4,4-dinitroheptanediol with formaldehyde, monomer concentration, solvent, type of Lewis acid catalyst, and reaction temperature were the important parameters affecting polymer yield and properties. In the polycondensation of formaldehyde with two nitramine diols only low molecular weight oligomers were obtained. GRA

N87-25473*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD OF CONTROLLING A RESIN CURING PROCESS Patent Application
Charles Neal Webster, inventor (to NASA) and Robert O. Scott, inventor (to NASA) (LTV Aerospace Corp., Dallas, Tex.) 30 Apr. 1987 21 p
(NASA-Case-MSC-21169-1; US-Patent-Appl-SN-044183) Avail: NTIS HC A02/MF A01 CSCL 11B

The invention relates to an analytical technique for controlling the curing process of fiber-reinforced composite materials that are formed using thermosetting resins. The technique is the percent gel method and involves development of a time-to-gel equation as a function of temperature. From this equation a rate-of-gel equation is then determined, and a percent gel is calculated which

is the product of rate-of-gel times time. Percent gel accounting is used to control the proper pressure application point in an autoclave cure process to achieve desired properties in a production composite part. NASA

N87-25474*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PROCESS FOR DEVELOPING CRYSTALLINITY IN LINEAR AROMATIC POLYIMIDES Patent Application
Terry L. StClair, inventor (to NASA) 7 Apr. 1987 29 p
(NASA-Case-LAR-13732-1; US-Patent-Appl-SN-035430) Avail: NTIS HC A03/MF A01 CSCL 11B

The process of the present invention includes first treating a polyamide-acid (such as LARC-TPI polyamide-acid) in an amide-containing solvent (such as N-methylpyrrolidone) with an aprotic organic base (such as triethylamine), followed by dehydrating with an organic dehydrating agent (such as acetic anhydride). NASA

N87-25475*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
POLYPHENYLQUINOXALINES CONTAINING ALKYLENEDIOXY GROUPS Patent Application
Paul M. Hergenrother, inventors (to NASA) and Stephen J. Havens, inventors (to NASA) 23 Mar. 1987 17 p
(NASA-Case-LAR-13601-1-CU; US-Patent-Appl-SN-028831)
Avail: NTIS HC A02/MF A01 CSCL 11B

Polyphenylquinoxalines were prepared from the reaction of bis(alpha-diketones) with aromatic bis(ortho-diamines). These polyphenylquinoxalines have lower glass transistion temperatures and melt viscosities and consequently better processability than known polyphenylquinoxalines. The properties of these polyphenylquinoxalines (tensile strength, modulus, elongation, adhesive strength, fracture energy, and solvent resistance) are comparable with the properties of known polyphenylquinoxalines. NASA

N87-25476*# Case Western Reserve Univ., Cleveland, Ohio. Inst. of Technology.
STABILITY AND RHEOLOGY OF DISPERSIONS OF SILICON NITRIDE AND SILICON CARBIDE Final Report
Donald L. Feke Jun. 1987 74 p
(Grant NAG3-468)
(NASA-CR-179634; NAS 1.26:179634) Avail: NTIS HC A04/MF A01 CSCL 11G

The relationship between the surface and colloid chemistry of commercial ultra-fine silicon carbide and silicon nitride powders was examined by a variety of standard characterization techniques and by methodologies especially developed for ceramic dispersions. These include electrokinetic measurement, surface titration, and surface spectroscopies. The effects of powder pretreatment and modification strategies, which can be utilized to augment control of processing characteristics, were monitored with these technologies. Both silicon carbide and nitride were found to exhibit silica-like surface chemistries, but silicon nitride powders possess an additional amine surface functionality. Colloidal characteristics of the various nitride powders in aqueous suspension is believed to be highly dependent on the relative amounts of the two types of surface groups, which in turn is determined by the powder synthesis route. The differences in the apparent colloidal characteristics for silicon nitride powders cannot be attributed to the specific absorption of ammonium ions. Development of a model for the prediction of double-layer characteristics of materials with a hybrid site interface facilitated understanding and prediction of the behavior of both surface charge and surface potential for these materials. The utility of the model in application to silicon nitride powders was demonstrated. Author

N87-25477# Technische Univ., Munich (West Germany). Fakultaet fuer Maschinenwesen.
HIGH VELOCITY IMPACTS OF SMALL MASSES ON LARGE-SURFACE PIEZOCERAMICS Ph.D. Thesis [HOCHGESCHWINDIGKEITSEIN SCHLAEGE KLEINER MASSEN IN GROSSFLAECHIGEN PIEZOKERAMIKEN]
Ulrich Weishaupt 1985 154 p In GERMAN
Avail: NTIS HC A08

An experiment using acoustic sensors for the determination of the mass and velocity distribution of dust particles in space near and far from the Earth is developed. The momentum of small masses impinging on the piezoceramic plate is determined from the amplitude and the time of the first measuring signal increase; the mass is determined from the rise time. The experimental and theoretical fundamentals of this generation of acoustic detectors are explained. Laboratory tests were performed in micrometeorite simulation devices. The accuracy of the momentum determination is much better than for the existing acoustic detectors. The mass determination accuracy is too low to permit a separation of mass and velocity in the momentum. The proposed flight experiment, whereby the time of flight of a particle from the impact on a thin foil to a target behind is measured, permits determination of mass and velocity. The tests also reveal the behavior of large surface piezoceramics during point-shock loading. ESA

N87-25478*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CRYOGENIC INSULATION SYSTEM Patent Application
Randall C. Davis, inventor (to NASA), Allan H. Taylor, inventor (to NASA), L. Robert Jackson, inventor (to NASA), and Patrick S. McAuliffee, inventor (to NASA) (Lockheed-California Co., Burbank.) 10 Jun. 1987 11 p
(NASA-Case-LAR-13506-1; US-Patent-Appl-SN-061182) Avail: NTIS HC A02/MF A01 CSCL 11C

This invention relates to reusable, low density high temperature cryogenic foam insulation systems and the process for their manufactire. A pacing technology for liquid hydrogen fueled, high speed aircraft is the development of a fully-reusable, flight-weight cryogenic insulation system for propellant tank structures. In the invention cryogenic foam insulation is adhesively bonded to the outer wall of the fuel tank structure. The cryogenic insulation consists of square sheets fabricated from an array of abutting square blocks. Each block consists of a sheet of glass cloth adhesively bonded between two layers of polymethacrylimide foam. Each block is wrapped in a vapor impermeable membrane, such as Kapton(R) aluminum-Kapton(R), to provide a vapor barrier. Very beneficial results can be obtained by employing the present invention in conjunction with fibrous insulation and an outer aeroshell, a hot fuselage structure with an internal thermal protection system. NASA

N87-25479*# National Aeronautics and Space Administration, Washington, D.C.
STRENGTHENING OF PHOSPHATE CERAMIC FOAM BY SILICON CARBIDE WHISKERS
B. V. Schetanov, V. N. Prilepskiy, L. A. Lapidovskaya, A. I. Chernyak, and I. V. Romanovich Jul. 1987 9 p Transl. into ENGLISH from Mekhanika Polimerov (USSR), no. 2, 1978 p 253-256 Original language document was announced in IAA as A78-42871 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TT-20025; NAS 1.77:20025) Avail: NTIS HC A02/MF A01 CSCL 11B

The influence of additions of SiC whiskers on the elastic modulus and flexural strength of phosphate ceramic foam is assessed. It is shown that the incorporation into the material composition of even small amounts (2.4 vol%) of SiC whiskers enhances the impact toughness and heat resistance of the ceramic foam. A 12.3 vol% of SiC whiskers leads to a more than threefold increase of the flexural strength. Strengthening of the phosphate ceramic foam is due to the fact that the whiskers hinder the propagation of matrix crack by increasing the work of matrix fracture. The whiskers reinforce only that volume of material which

is occupied by solid matter, whereas they do not reinforce the pores. Author

N87-25480*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EVALUATION OF CANDIDATE OXIDATION RESISTANT MATERIALS FOR SPACE APPLICATIONS IN LEO
Sharon Rutledge, Bruce Banks, Frank DiFilippo, Joyce Brady, Therese Dever, and Deborah Hotes (Cleveland State Univ., Ohio.) 1986 16 p Presented at the Workshop on Atomic Oxygen Effects, Pasadena, Calif., 10-11 Nov. 1986; sponsored by JPL
(NASA-TM-100122; E-3669; NAS 1.15:100122) Avail: NTIS HC A02/MF A01 CSCL 11C

Ground based testing of materials considered for polyimide (Kapton) solar array blanket protection and graphite-epoxy stroctural member protection was performed in an RF plasma asher. Protective coatings on Kapton from various commercial sources and from NASA Lewis Research Center were exposed to the air plasma; and mass loss per unit area was measured for each sample. All samples evaluated provided some protection to the underlying surface, but metal-oxide-fluoropolymer coatings provided the best protection by exhibiting very little degradation after 47 hr of asher exposure. Mica paint was evaluated as a protective coating for graphite-epoxy structural members. Mica appeared to be resistant to attack by atomic oxygen, but only offered limited protection as a paint. this is believed to be due to the paint vehicle ashing underneath the mica leaving unattached mica flakes lying on the surface. The protective coatings on Kapton evaluated so far are promising but further research on protection of graphite-epoxy support structures is needed. Author

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N87-25481# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ANNULAR LIQUID PROPELLANT JETS: INJECTION, ATOMIZATION AND IGNITION
Avi Birk and Phil Reeves Mar. 1987 66 p
(AD-A179736; AD-E750952; BRL-TR-2780) Avail: NTIS HC A04/MF A01 CSCL 21I

Research is directed at determining the hydrodynamics and ignition properties of HAN based liquid propellant (LP) annular sprays. The experimental fixture consists of an annular injector capable of injecting up to 4 cc of LP, in 3 to 20 msec, with velocities reaching 120 m/s into a windowed chamber pressurized up to 15 MPa. Pressures and injection flow rate are recorded. High speed cinematography is used extensively. Two types of experiments are conducted: cold atomization and hot ignition. In the cold tests the LP and other liquids are injected into a room temperature argon gas. In the hot tests, LP is injected into the high pressure and temperature environment of steam and argon (22%, 78%) obtained from prior combustion of oxygen-hydrogen-argon mixture in the chamber. Atomization is promoted when injecting with higher velocities into denser gas. Injection along a protruding center bolt promotes jet divergence; otherwise, jet convergence is observed. No particular standard atomization theory accounts for the observations. GRA

N87-25482# Bonner and Moore Associates, Inc., Houston, Tex.
HIGH DENSITY JET FUEL AVAILABILITY STUDY. PHASE 1: REFINING INDUSTRY SURVEY Interim Report, 15 Nov. 1985 - 11 Aug. 1986
F. P. Frederick 30 Jan. 1987 59 p
(Contract F33615-85-C-2529)
(AD-A179800; AFWAL-TR-86-2083) Avail: NTIS HC A04/MF A01 CSCL 21D

A survey of ten refining companies to explore production schemes, raw materials processing costs and potential quantities of high-density jet fuel is summarized. Estimated regional and national production capabilities are presented along with estimated manufacturing costs. Access to potential feedstock samples is also discussed. Refining issues and consideration for further study are presented. GRA

N87-25483# AeroChem Research Labs., Inc., Princeton, N. J.
PROPELLANT AGING RESEARCH Final Report, 1 Aug. 1983 - 1 Sep. 1986
Douglas B. Olson and Robert J. Gill Feb. 1987 77 p
(Contract F04611-83-C-0037)
(AD-A179814; TP-460; AFRPL-TR-86-096) Avail: NTIS HC A05/MF A01 CSCL 21I

Chemical aging of solid rocket propellants and ingredients was studied. The thermal decomposition rate coefficients of cyclotrimethylene trinitramine, butanetriol trinitrate, and ammonium perchlorate were measured from about 310 to 375 K using a NOx chemiluminescence analyzer. The decomposition of butanetriol trinitrate was shown to undergo a mechanism change at 333 K. Six cured mixtures of hydroxy terminated polybutadiene binder, ammonium perchlorate, aluminum, and stabilizer were prepared, exposed to four reactive gases for 54 hours at 344 K, and analyzed for weight change, sol/gel content, and molecular weight of sol. These techniques were not sensitive enough to reliably analyze early changes due to chemical aging. Polymer chemiluminescence resulting from chemical degradation of this series of propellant mixtures by reactive gases was also studied from 300 to 350 K. This work showed that the stabilizer methylnitroanilline significantly reduces chemical reactions occurring upon exposure to air but not upon exposure to NO2/air. The results of this program demonstrate the capabilities of the real-time NOx offgas analysis technique and the polymer chemiluminescence technique. GRA

N87-25484# Lawrence Livermore National Lab., Calif.
A MODEL FOR CALCULATING THE THRESHOLD FOR SHOCK INITIATION OF PYROTECHNICS AND EXPLOSIVES
D. E. Maiden Mar. 1987 20 p Presented at the 3rd International Conference of the Groupe de Travail de Pyrotechnic Spatiale and 12th International Pyrotechnics Seminar, Paris, France, 8 Jun. 1987
(Contract W-7405-eng-48)
(DE87-007444; UCRL-96360; CONF-870668-3) Avail: NTIS HC A02/MF A01

A model is proposed for predicting the shock pressure P and pulse pulse width required to ignite porous reactive mixtures. Essentially, the shock wave collapses the voids, forming high-temperature hot spots that ignite the mixture. The pore temperature is determined by numerical solution of the equations of motion, viscoplastic heating, and heat conduction. The pore radius is determined as a function of the pore size, viscosity, yield stress, and pressure. Temperature-dependent material properties and melting are considered. Ignition occurs when the surface temperature of the pore reaches the critical hot-spot temperature for thermal runaway. Data from flyer-plate impact experiments were analyzed and the pressure pulse at the ignition threshold was determined for 2Al/Fe2O3(thermite) and the high explosives TATB, PBX 9404, and PETN. Mercury intrusion porosimetry was performed on the samples and the pore size distribution determined. Theoretical and numerical predictions of the ignition threshold are compared with experiment. Results show that P(2)tau appears to be an initiation property of the material. DOE

N87-25485# Sandia National Labs., Albuquerque, N. Mex.
SELF-CHECK DEVELOPMENT FOR LINbO3 EXPLOSIVE MONITORS
S. F. Kuehn 1987 51 p Presented at the 14th Transducer Workshop, Colorado Springs, Colo., 16 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-007844; SAND-86-2622C; CONF-870692-1) Avail: NTIS HC A04/MF A01

This paper reports on the design criteria and experimental results associated with the development of a self-check scheme in lithium niobate explosive monitors. These monitors have been developed at Sandia National Laboratories and a patent is pending. This monitor was developed to measure timing of explosive detonations with sub-microsecond resolution. Because the monitor is usually non-recoverable and undergoes catastrophic damage, its condition has to be ascertained prior to explosive detonation. This paper discusses various self-check methods investigated and their practicality. The report then focuses on one method that uses an undesirable characteristic of piezoelectric crystals to perform a useful function, the pyroelectric self-check. DOE

N87-25486# Materials Research Labs., Ascot Vale (Australia).
A COMPARISON BETWEEN SEVERAL STANDARD METHODS USED TO CHARACTERIZE THE IGNITION/IGNITION TRANSFER OF PYROTECHNIC COMPOSITIONS. A COLLABORATIVE STUDY. PART 1: DATA
P. Barnes, L. DeYong, J. Domanico, P. Twadawa, and F. Vanlenta Feb. 1987 85 p
(AD-A180297; MRL-R-1043-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 19A

A collaborative study has been made of samples of pyrotechnic compositions (delays, colored smokes and a percussion primer) by a number of laboratories. A variety of techniques have been used to characterize the ignition/ignition transfer behavior of the compositions. GRA

N87-25487# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
SHALE JP-4 ADDITIVE EVALUATION Final Report, Sep. 1983 - May 1985
Teresa A. Boos and Timothy L. Dues Oct. 1986 125 p
(AD-A180485; AFWAL-TR-85-2118) Avail: NTIS HC A06/MF A01 CSCL 21D

A shale JP-4 jet fuel was obtained from the Caribou Refinery of Woods Cross UT as the test fuel. Combinations of additives in varying concentrations were blended to make the test samples. The thermal and storage stability, lubricity, conductivity and water separation characteristics of the samples were studied over 15 months. The additives chosen were nine antioxidants, at the minimum and two times the maximum concentration, and four corrosion inhibitors, at the minimum and maximum concentration. The limits were set by the JP-4 specification. Other additives in the test program were Fuel System Icing Inhibitor (FSII), anti-static additive, JFA-5 and metal deactivator. Five-gallon test samples were stored for 15 months: antioxidant samples in a 110 F oven and corrosion inhibitor samples in 70 F to 80 F room storage. Two drums of fuel containing FSII, anti-static additive, and maximum antioxidant and corrosion inhibitor were stored at other conditions, one in cold storage and one at ambient conditions (outdoors). GRA

N87-25488*# New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.
AN ANALYSIS OF BIPROPELLANT NEUTRALIZATION FOR SPACECRAFT REFUELING OPERATIONS
David Kauffman *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 14 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 14 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 21H

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.
For biological materials see *55 Space Biology.*

N87-25488# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
A SYSTEMS ARCHITECTURE FOR EXTRATERRESTRIAL PRODUCTION
H. H. Koelle 15 Jan. 1987 25 p
(ILR-Mitt-173; ETN-87-99918) Avail: NTIS HC A02/MF A01

Eight locations where space manufacturing (SM) could take place are identified, beginning with the low-near-Earth-orbit up to astroids in interplanetary space. A contextual map is offered, illustrating the evolution of space activities relevant for SM. Twenty potential product groups suitable for SM are listed, and their possible introduction with respect to time is shown. Functions to be performed during SM are outlined, and their distribution over locations indicated. This list of functions is used to derive subsystems and elements required to carry them out. A matrix of system functions against subsystems illustrates the interrelationships between these two dimensions. The subsystem transportation equipment and facilities are used as an example to indicate the allocations of the 20 elements listed to the individual locations of SM. ESA

N87-25489*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SAMPLE LEVITATION AND MELT IN MICROGRAVITY Patent Application
Philip I. Moynihan, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 30 Apr. 1987 16 p
(Contract NAS7-918)
(NASA-Case-NPO-17022-1-CU; US-Patent-Appl-SN-066450)
Avail: NTIS HC A02/MF A01 CSCL 07D

A system is described for maintaining a sample material in a molten state and away from the walls of a container in a microgravity environment, as in a space vehicle. A plurality of sources of electromagnetic radiation, such as of an infrared wavelength, are spaced about the object, with the total net electromagnetic radiation applied to the object being sufficient to maintain it in a molten state, and with the vector sum of the applied radiation being in a direction to maintain the sample close to a predetermined location away from the walls of a container surrounding the sample. For a processing system in a space vehicle that orbits the Earth, the net radiation vector is opposite the velocity of the orbiting vehicle. NASA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N87-25490# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
VARIATION OF FORM AND DIMENSION FOR MINIMUM WEIGHT DESIGN OF CONTINUOUS STRUCTURES
Uwe-Laszlo Berkes Jan. 1987 46 p
(ILR-Mitt-172; ETN-87-99917) Avail: NTIS HC A03/MF A01

A method for minimum weight design of arbitrary loaded continuous structures is outlined. The optimization algorithm is controlled by a fast fully stressed design procedure and the structure stress-strain behavior is computed by the finite element code. Both are completed by pre and postprocessors. To reach the minimum weight design two tasks are carried out: dimension variation in general elementwise thickness adaption to the stress limits; and form variation by element reduction in the finite element set. For comparison of the convergence behavior and accuracy of this code, results are compared with Michell reference structures and their analytic solutions. The method shows fast convergence and reaches the theoretical optimum efficiently. ESA

N87-25491* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD FOR MACHINING HOLES IN COMPOSITE MATERIALS Patent
Julia G. Daniels, inventor (to NASA), Frank E. Ledbetter, III, inventor (to NASA), Johnny M. Clemons, inventor (to NASA), Benjamin G. Penn, inventor (to NASA), and William T. White, inventor (to NASA) 21 Jul. 1987 5 p Filed 3 Dec. 1985 Supersedes N86-23750 (24 - 14, p 2263)
(NASA-Case-MFS-28044-1; US-Patent-4,680,897; US-Patent-Appl-SN-804039; US-Patent-Class-51-281-R; US-Patent-Class-408-1-R) Avail: US Patent and Trademark Office CSCL 13H

A method for boring well defined holes in a composite material such as graphite/epoxy is discussed. A slurry of silicon carbide powder and water is projected onto a work area of the composite material in which a hole is to be bored with a conventional drill bit. The silicon carbide powder and water slurry allow the drill bit, while experiencing only normal wear, to bore smooth, cylindrical holes in the composite material.
Official Gazette of the U.S. Patent and Trademark Office

N87-25492* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEPLOYABLE GEODESIC TRUSS STRUCTURE Patent
Martin M. Mikulas, Jr., inventor (to NASA), Marvin D. Rhodes, inventor (to NASA), and J. Wayne Simonton, inventor (to NASA) 7 Jul. 1987 9 p Filed 20 Feb. 1986 Supersedes N86-24867 (24 - 15, p 2443)
(NASA-Case-LAR-13113-1; US-Patent-4,677,803; US-Patent-Appl-SN-831371; US-Patent-Class-52-646; US-Patent-Class-52-108; US-Patent-Class-52-632; US-Patent-Class-182-152) Avail: US Patent and Trademark Office CSCL 13I

A deployable geodesic truss structure which can be deployed from a stowed state to an erected state is described. The truss structure includes a series of bays, each bay having sets of battens connected by longitudinal cross members which give the bay its axial and torsional stiffness. The cross members are hinged at their mid point by a joint so that the cross members are foldable for deployment or collapsing. The bays are deployed and stabilized by actuator means connected between the mid point joints of the cross members. Hinged longerons may be provided to also connect the sets of battens and to collapse for stowing with the rest of the truss structure.
Official Gazette of the U.S. Patent and Trademark Office

N87-25493# PEI Associates, Inc., Cincinnati, Ohio.
UNDERGROUND STORAGE TANK CORRECTIVE ACTION TECHNOLOGIES Final Report, Jan. - Dec. 1986
R. Cochran Jan. 1987 205 p
(Contract EPA-68-02-3995)
(PB87-171278; EPA-625/6-87-015) Avail: NTIS HC A10/MF A01 CSCL 13B

The document contains information on corrective action technologies for releases from underground storage tanks (UST). It probes general background information on UST construction techniques, leak detection methods, and failure mechanisms. It also addresses transport pathways of released substances, techniques for evaluating the extent of a release, factors influencing risk to human health and the environment, techniques for selecting initial corrective-action response technologies, and detailed technical profiles of corrective action technologies. Emphasis is on corrective actions associated with releases from gasoline and petroleum USTs. GRA

N87-25494# Enviresponse, Inc., Livingston, N.J.
LEAK PREVENTION IN UNDERGROUND STORAGE TANKS: A STATE-OF-THE-ART SURVEY
A. C. Gangadharan, T. V. Narayanan, R. Raghavan, and G. Amoruso May 1987 104 p Prepared in cooperation with Foster Wheeler Corp.,Livingston, N.J.
(Contract EPA-68-03-3255)
(PB87-168662; EPA/600/2-87/018) Avail: NTIS HC A06/MF A01 CSCL 13B

The overall objectives were to examine the structural design and operational practices associated with underground storage tank (UST) systems in the context of preventing leaks from such systems and identify areas for further research and development to advance the technology. Recommendations derived include: establishing a nations data base to provide information on failure rates and mechanisms and their correlation to design, engineering, installation, and operation practices and corrective actions; assessing the effectiveness of cathodic protection methods, their interaction with the environment, and the performance of retrofitting existing USTs; developing compatibility protocols for the selection of appropriate materials of construction and long-term protection; and developing methods to assess the life expectancy of both new and existing systems and to extend their useful life. GRA

N87-25495*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
IMPROVED METHOD AND APPARATUS FOR WASTE COLLECTION AND STORAGE Patent Application
W. E. Thornton, inventor (to NASA) and Henry Whitmore, inventor (to NASA) 7 Apr. 1987 33 p
(NASA-Case-MSC-21025-1; US-Patent-Appl-SN-035401) Avail: NTIS HC A03/MF A01 CSCL 13B

A method and apparatus for the collection of fecal matter are designed to operate efficiently in a zero gravity environment. The system comprises a waste collection area within a body having a seat opening. Low pressure within the waste collection area directs fecal matter away from the user's buttocks and prevents the escape of undesirable gases. The user actuates a piston covered with an absorbent pad that sweeps through the waste collection area to collect fecal matter, scrub the waste collection area, press the matter against an end of the waste collection area and retracts, leaving the used pad. Multiple pads are provided on the piston to accommodate multiple uses of the system. Also a valve allows air to be drawn through the body, which valve will not be plugged with fecal matter. A sheet feeder feeds fresh sheets of absorbent pad to a face of the piston with each actuation. NASA

N87-25496*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TRUSS-CORE CORRUGATION FOR COMPRESSION LOADS Patent Application
Randall C. Davis, inventor (to NASA) and L. Robert Jackson, inventor (to NASA) 5 Mar. 1987 15 p
(NASA-Case-LAR-13438-1; NAS 1.71:LAR-13438-1; US-Patent-Appl-SN-022298) Avail: NTIS HC A02/MF A01 CSCL 13M

A corrugated panel structure for supporting compressive loads is described which includes curved cap strips separated by truss-core web segments. The truss-core web segments are formed from first and second flat panels with a corrugated filler therebetween. The corrugated filler extends in the direction of the compressive load. As a result, all components of the panel structure have a compressive load carrying capability resulting in a high strength-to-weight ratio when the compressive load is limiting. Application to rocket and aircraft structures is suggested. NASA

N87-25497# Joint Publications Research Service, Arlington, Va.
USSR REPORT: ENGINEERING AND EQUIPMENT
18 Feb. 1987 94 p Transl. into ENGLISH from various Russian articles
(JPRS-UEQ-87-004) Copyright Avail: NTIS HC A05/MF A01

This journal of translated articles from USSR publications is divided into these areas on engineering and equipment: Industrial technology; Navigation and guidance systems; High energy devices, optics and photography; Fluid mechanics; and Mechanics of solids. A representational title from each area might be: Suspension of machine tools to dampen vibrations tested; Digital simulator of DEKKA radio navigation system signals; Climatic test bench for structural elements of parabolic reflectors; Characteristics of hypersonic flow past models in wind tunnel of various types; and

Effects of initial stresses on surface waves in system consisting of prestressed compressible body and viscous compressible fluid. For individual titles, see N87-25498 through N87-25504.

N87-25498# Joint Publications Research Service, Arlington, Va.
DEVELOPMENTS IN MACHINE RELIABILITY, SERVICE LIFE REVIEWED **c38**
K. V. Frolov *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 29-42 Transl. into ENGLISH from Vestnik Akademii Nauk SSSR (Moscow, USSR), no. 8, Aug. 1985 p 74-84 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

The effectiveness of the utilization in the national economy of power, production, transport, and other machines is determined by the quality and depends on the solution of the problem of reliability. Reliability and the technical perfection of machines are the principal components of quality. It is increasingly difficult to insure reliable operation in machines, due to increasing complexity as new capabilities are added, as well as broader operating conditions and more rugged construction. The theory of reliability widely uses mathematical methods of determinate and stochastic analysis for the investigation, evaluation, and monitoring of reliability. It also uses similarity methods which permit establishing criteria for selecting analogs and substantiating technical characteristics and work capacity of articles being designed. Reliability of machinery is discussed in detail. E.R.

N87-25499# Joint Publications Research Service, Arlington, Va.
COMPARATIVE INVESTIGATIONS OF VIBROACOUSTICS OF METAL, POLYMER, AND METAL-POLYMERS GEARINGS **c39**
I. V. Zhuk and S. A. Osipenko *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 43-47 Transl. into ENGLISH from Vesti Akademii Navuk BSSR: Seriya Fizika-Tekhnichnykh Navuk (Minsk, USSR), no. 2, Jan. - Mar. 1986 p 59-62 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

Gearings are one of the main sources of noise and vibrations of operating machines and mechanisms. Reducing their vibroacoustic characteristics makes it possible to improve the working conditions of service personnel, increase production quality, and increase the reliability and service life of machines. Using polymer materials in the design of gearings is one way of reducing noise and vibrations. One or both wheels comprising the gearing may be manufactured entirely of polymer material or may contain necessary polymer design components. The effectiveness of using polymer and metal-polymer material wheels instead of metal ones for improving the vibroacoustic characteristics of gearings is established. Wheel types are given, test parameters are discussed as are results and conclusions. Author

N87-25500# Joint Publications Research Service, Arlington, Va.
CLIMATIC TEST BENCH FOR STRUCTURAL ELEMENTS OF PARABOLIC REFLECTORS **c89**
Yu. R. Bapbyyev, M. A. Gurbanyazov, I. S. Lisker, and M. Khandurdyyev *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 51-56 Transl. into ENGLISH from Izvestiya Akademii Nauk Turkmenskoy SSR: Seriya Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk (Ashkhabad, USSR), no. 1, Jan. - Feb. 1986 p 20-24 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

A bench was developed for climatic tests of the structural elements of large antenna arrays. Because of the mobility of the unit for programmed implementation of the recording operations, connection of both the F-30K measuring complex and similar complexes for investigation of slowly variable processes and of the measuring complex based on the Elektronika TZ-16M computer is possible, which provides complete automation of the process of measurement and recording of the thermal pattern of the structural elements of antenna arrays during rapidly variable heat transfer processes. The temperature fields of fragments of the reflecting surface of large parabolic concentrating systems were investigated on the bench. Author

N87-25501# Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF HYPERSONIC FLOW PAST MODELS IN WIND TUNNELS OF VARIOUS TYPES **c02**
V. I. Alferov, A. N. Labazkin, and A. P. Rudakova *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 66 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Mekhanika Zhidosti i Gaza (Moscow, USSR), no. 2, Mar. - Apr. 1986 p 181-184 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

A study of longitudinal hypersonic flow past models with obtuse and acute conical noses, and a hemispherical nose, was made for a comparative evaluation of three different wind tunnels. Tests were performed at gas stream velocities in two hypersonic wind tunnels, one with Joule effect and the other with electric arc preheating of the gas in the chamber, and in an ultra high speed wind tunnel. Total pressure in the forechamber was measured, as well as the distribution of static pressure over the model surface, and along the nozzle, deflection angle of the shock wave, distance from the tip of the nose to the point of separation of the shock wave, and the critical nose cone angle corresponding to separation at the tip. A spherical source of gas stream was used with a conical nozzle, which made it necessary to account for nonuniformity of flow in the oncoming stream. The results indicate formation of an entropic relaxation layer at the surface of nose cones, especially in the ultra high speed wind tunnel but also in the hypersonic wind tunnel with electric arc preheating. The behavior of a real gas during hypersonic flow past bodies can be reproduced in an ultra high speed wind tunnel and to a much lesser degree in a preheated tunnel. Author

N87-25502# Joint Publications Research Service, Arlington, Va.
ACOUSTIC CONTINUITY TRANSDUCER FOR FLOW METERS OPERATING IN TWO-PHASE MEDIA **c35**
A. A. Alekseyev and A. L. Seyfer *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 67 Transl. into ENGLISH from Izmeritelnaya Tekhnika (Moscow, USSR), no. 4, Apr. 1986 p 42-43 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

Existing acoustic flow and continuity meters for use in gas-liquid media were supplemented with an ultrasonic one operating on the basis of change in the acoustic impedance, this change depending on the frequency of ultrasonic waves as well as on the changes in their velocity and attenuation in the medium. The acoustic flow-through transducer module consisting of a coaxial hollow piezoelectric radiator-inside-receiver pair is fitted into a break along the pipeline and fastened to the latter at both ends through flanges so as to close the break. A typical application is measuring the gas content in an air-water mixture. Measurement are made with the radiator excited by electric signals from an oscillator and the receiver connected to a phase-difference meter. With the frequency varied from 0 to 200 kHz, the signal phase is measured at each frequency first with pure water and then with pure air flowing through. On the resulting phase frequency characteristic is selected the frequency corresponding to the maximum difference between signal phases with full and empty module ›spectively and subsequent actual measurements are made at that frequency. Author

N87-25503# Joint Publications Research Service, Arlington, Va.
MOTION OF BODY IN VIBRATING FLUID **c34**
B. A. Lugovtsov and V. L. Sennitskiy *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 68 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 289, no. 2, 1986 p 314-317 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

Motion of a solid body in a vibrating fluid is analyzed theoretically, for confirmation of the experimentally discovered anomaly that a body made of a material heavier than the liquid will buoy and a body made of a material lighter than the liquid will sink when the vessel containing the fluid performs sufficiently intense translational oscillations. While a closed vessel performs such oscillations relative to some reference system, the body

moves under the force of gravity and fluid pressure. The fluid is assumed to be an ideal incompressible one, and initially at rest so that its subsequent motion is potential. The body is assumed to be homogeneous sphere. The equation of motion for the center of inertia of this sphere is formulated in a noninertial system of coordinates rigidly fixed to the vessel, with the appropriate initial conditions for the radius-vector of that center of the sphere. This equation and the equation of continuity for the velocity potential, with appropriate boundary conditions, need not be solved for determination of the radius-vector as a function of time. Inasmuch as the Hamilton variational principle is applicable, the corresponding system of Lagrange equations for kinetic energy and working force is derived and then averaged with a displacement resolved into a large slowly varying one and a small fast varying one. An analysis of the Lagrange equations in this form confirms the anomalous behavior of a body under the given conditions. Author

N87-25504# Joint Publications Research Service, Arlington, Va.
SIMULATION OF RESONANT VIBRATIONS OF VIBRATION INSULATION SYSTEM UNDER EFFECT ON LOW-FREQUENCY PARAMETRIC EXCITATION **c39**
S. V. Vlasov, M. D. Genkin, E. G. Gudushauri, and V. G. Yelezov *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 78-84 Transl. into ENGLISH from Mashinovedeniye (Moscow, USSR), no. 3, May - Jun. 1986 p 89-92 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

In connection with the trend noted in modern engineering toward a decrease in stiffness of equipment suspensions and the application of multistage vibration insulation systems, the problem of reducing low frequency, and especially resonant, vibrations in vibration insulation systems is acquiring important practical significance. A study was made of the possibility of lowering the resonant vibrations of vibration insulating systems by means of parametric excitation of them. The basis of the investigated method of vibration protection is experiments in which the effect of vibration and noise on the human organism with different spectral structure has been studied. The results of reference permit the conclusion to be drawn that a wide-band or polyharmonic process in the general case has a less harmful effect on the human organism than sound of a pure tone with identical integral power of them. This means that a vibration protection system that redistributes the energy of harmonic vibrations of the frequency band is just as effective as a system that lowers the energy of these vibrations. Author

N87-25505# National Bureau of Standards, Gaithersburg, Md. Center for Fire Research.
CIGARETTE IGNITION OF SOFT FURNISHINGS: A LITERATURE REVIEW WITH COMMENTARY
John F. Krasny Apr. 1987 108 p
(NBSIR87-3509) Avail: NTIS HC A06/MF A01

Literature pertinent to the ignition by smoldering cigarettes of upholstered furniture and mattresses (soft furnishings) was searched through early 1986. This included literature on the smoldering behavior of cigarettes in air; their behavior on a variety of substrates simulating soft furnishings; mechanism of smoldering in substrates; relative cigarette ignition resistance of substrates; and relative propensity of commercial cigarette packings to ignite substrates. According to the reviewed literature, the smoldering behavior of cigarettes on substrates differs from that of cigarettes burning in air: on substrates, cigarette temperatures tend to be lower, and burning rates slower. These differences seem to be larger for substrates which ignite than for those which self-extinguish after the cigarette burns out. The characteristics of soft furnishings which insure resistance to cigarette ignition have been established, but those of cigarettes with low propensity to ignite furnishings have not. No mathematical model has been reported for the interaction of cigarette and substrate, but some empirical data do exist. Author

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N87-25506 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Systems Group.
THE RADARSAT MODULAR OPTO-ELECTRONIC MULTISPECTRAL SCANNER (R-MOMS): A POTENTIAL CANDIDATE FOR THE POLAR ORBITING PLATFORM (POP) ALSO
D. Meissner and H. L. Werstiuk 1986 11 p Presented at the 37th International Astronautical Federation Congress on Space: New Opportunities for All People, innsbruck, Austria, 4-11 Oct. 1986 Previously announced in IAA as A87-15855 Submitted for publication
(MBB-UR-873/86; IAF-86-81; ETN-87-99936) Copyright Avail: Issuing Activity

The design and performance characteristics of the Radarsat opto-electronic scanner (R-MOMS) are outlined, and its use on the Polar Orbiting Platform (POP) is proposed. The R-MOMS consists of 4 spectral channels with center wavelengths 0.485, 0.555, 0.650, and 0.825 microns, with 13,500 usable pixels. Strip width is 405 km, with a ground pixel size of 60, 30, 30, and 30 m for the 4 bands. For POP, an along-track stereo mode can be added. ESA

N87-25507# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
FUTURE TECHNOLOGIES AND THE ABUNDANCE OF CHOICE
Dietrich Davidts 1986 16 p Presented at Intelevent 86, Munich, West Germany, 19-22 Oct. 1986
(MBB-UR-927/86; ETN-87-99946) Avail: Issuing Activity

Developments in communication and broadcasting technology over the next 20 years are discussed. Equipment and systems such as satellites and fiber optics networks, and services such as facsimile transmission and paging are reviewed. ESA

N87-25508# Massachusetts Inst. of Tech., Lexington.
MEASURED SPECTRAL EXTENT OF L- AND X-BAND RADAR REFLECTIONS FROM WIND-BLOWN TREES Progress Report
J. B. Billingsley and John F. Larrabee 6 Feb. 1987 110 p
(Contract F19628-85-C-0002)
(AD-A179942; CMT-57; ESD-TR-86-153) Avail: NTIS HC A06/MF A01 CSCL 20N

Measurements of the spectral content of L- and X- band radar reflections from several resolution cells containing wind-blown trees are examined under a wide variety of typical wind conditions. Most of the discernible energy (i.e., within 60 dB of the peak zero-Doppler level) occurs in the spectra at Doppler velocities usually less than 1.0 m/s, or at most 2.0 m/s on very windy days. The rates of decay of energy with increasing Doppler velocity in the tails of the spectral distributions at spectral off-sets well removed from zero often appear to be approximately exponential. Estimates of rates of exponential decay in the spectral tails as a function of windspeed are provided in three regimes of windspeed. Author (GRA)

N87-25509# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
RADAR CROSS SECTION MEASUREMENTS
Robert B. Dybdal 30 Sep. 1986 71 p
(Contract F04701-85-C-0086)
(AD-A180041; TR-0086(6925-05)-5; SD-TR-86-83) Avail: NTIS HC A04/MF A01 CSCL 17I

The fundamentals of radar cross section measurements are reviewed. Measurement facilities, including the present research activities on compact range techniques, are then described. Instrumentation radars have benefited from both wide bandwidth

electronics and digital processing capabilities. Fourier transform techniques, in particular, provide both additional information on target scattering, and increased measurement accuracy by isolating the target from radar returns from the measurement facility. The frequency coverage has also been extended to include millimeter wave frequencies. Achievable accuracy is important in any measurement program, and those factors that limit the accuracy of radar cross section measurements are discussed. GRA

N87-25510# Lawrence Livermore National Lab., Calif.
RADIATION (ABSORBING) BOUNDARY CONDITIONS FOR ELECTROMAGNETIC FIELDS
R. M. Bevensee and S. T. Pennock Jan. 1987 5 p Presented at the Antennas and Propagation Society Symposium, Blacksburg, Va., 15 Jun. 1987
(Contract W-7405-eng-48)
(DE87-004351; UCRL-95899; CONF-870655-2) Avail: NTIS HC A02/MF A01

An important problem in finite difference or finite element computation of the electromagnetic field obeying the space-time Maxwell equations with self-consistent sources is that of truncating the outer numerical boundaries properly to avoid spurious numerical reflection. Methods for extrapolating properly the fields just beyond a numerical boundary in free space have been treated by a number of workers. This report avoids plane wave assumptions and derives boundary conditions more directly related to the source distribution within the region. The Panofsky-Phillips' relations, which enable one to extrapolate conveniently the vector field components parallel and perpendicular to a radial from the coordinate origin chosen near the center of the charge-current distribution are used to describe the space-time fields. DOE

N87-25511* National Aeronautics and Space Administration. Pasadena Office, Calif.
ANTIMULTIPATH COMMUNICATION BY INJECTING TONE INTO NULL IN SIGNAL SPECTRUM Patent
Faramaz Davarian, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 23 Jun. 1987 11 p Filed 2 May 1985 Supersedes N85-29121 (23 - 18, p 3089)
(NASA-Case-NPO-16414-1-CU; US-Patent-4,675,880; US-Patent-Appl-SN-729719; US-Patent-Class-375-39; US-Patent-Class-375-54; US-Patent-Class-375-101; US-Patent-Class-375-102; US-Patent-Class-455-65; US-Patent-Class-332-23-A) Avail: US Patent and Trademark Office CSCL 17B

A transmitter for digital radio communication creates a null by balanced encoding of data modulated on an RF carrier, and inserts a calibration tone within the null. This is accomplished by having the calibration tone coincide in phase and frequency with the transmitted radio frequency output, for coherent demodulation of data at the receiver where the tone calibration signal is extracted and used for multipath fading compensation.
Official Gazette of the U.S. Patent and Trademark Office

N87-25512*# Texas A&M Univ., College Station. Dept. of Electrical Engineering.
ERROR CONTROL CODING FOR SATELLITE AND SPACE COMMUNICATIONS Final Technical Report
Costas N. Georghiades and Lin Shu 28 Jul. 1987 37 p
(Grant NAG5-778)
(NASA-CR-181127; NAS 1.26:181127) Avail: NTIS HC A03/MF A01 CSCL 17B

The optical direct detection channel is discussed. It is shown how simple trellis coded modulation can be used to improve performance or increase throughput (in bits per second) without a bandwidth expansion and no performance loss. In fact, a modest performance gain can be achieved. The concentration is on signals derived from the pulse-position modulation format by allowing overlap. Author

N87-25513# Case Inst. of Tech., Cleveland, Ohio.
ATMOSPHERIC PROPAGATION STUDIES AT NEAR-MILLIMETER WAVELENGTHS Final Report, 1 Oct. 1981 - 31 Aug. 1986
Paul C. Claspy and Francis L. Merat 2 Mar. 1987 35 p
(Contract DAAG29-81-K-0172)
(AD-A180426; ARO-18527.4-GS) Avail: NTIS HC A03/MF A01 CSCL 04A

The principal experimental data obtained from this program are the results of static measurements of the sensitivity of attenuation at 337 GHz to atmospheric water vapor concentration in the temperature range of 13 to 24 C. Estimates were also made, from that data, of the absolute attenuation coefficient for clear air at that frequency and over the same temperature range. As a result of reliability difficulties experienced with the laser transmitter, it was not possible to complete experiments which would have yielded coherence property data. Major theoretical contributions of the program include the development of a weak fluctuation model of propagation of a general beam wave through an atmosphere characterized by a fluctuating complex index of refraction, and the complete development and analysis of the signal processing techniques necessary to invert intensity data from a quasi optical experiment to obtain the atmospheric mutual coherence function (MCF). GRA

N87-25514# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Sciences Group.
PROFILER/SATELLITE INTERFERENCE ANALYSIS
R. B. Chadwick Feb. 1987 30 p
(PB87-176400; NOAA-TM-ERL-ESG-24) Avail: NTIS HC A03/MF A01 CSCL 17B

An engineering analysis of potential radio interference between the Wind Profiler Demonstration Network and three NOAA satellite-based systems is presented. These three systems are: Geostationary Operational Environmental Satellite (GOES) system, the Search and Rescue Satellite (SARSAT) system, and the TIROS series Data Collection System (TDCS). The Profiler considered in this analysis is the UHF Wind Profiler to be supplied by Sperry Corporation under a contract awarded June 1986. The analysis is based on the interference-to-noise ratio at the satellite receiver. Several engineering changes have been made to the original contract to reduce potential interference. The effects of these changes are presented. GRA

N87-25515# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Raumfahrt.
SATELLITE COMMUNICATION FROM USER TO USER [SATELLITENKOMMUNIKATION VON NUTZER ZU NUTZER]
Manfred Gern 1986 5 p Repr. from Nachr. Elektron. U. Telematik, v. 40, no. 1/2, 1986 p 24-27 In GERMAN
(MBB-UR-866/86; ETN-87-99935) Avail: Issuing Activity

Satellite communication systems which allow a multitude of user-to-user, point-to-point, and multipoint connections, are presented. The bit rates are 64 kbit/sec and multiples, up to 1.92 Mbit/sec. If required, the ground-stations are installed at the customer's site or at suitable locations in order to serve several customers. However, technical requirements for station location have also to be fulfulled, in order to avoid interference with terrestrial radio services. The increasing number of participants to Satellite Multi Service and INTELSAT Business Services imposes the solution of the problem of communication using cheap techniques. The changes of the German Federal Post Office also permit the economic use of satellite radio techniques for short distances. ESA

N87-25516*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE PERFORMANCE OF TRELLIS CODED MULTILEVEL DPSK ON A FADING MOBILE SATELLITE CHANNEL
Marvin K. Simon and Dariush Divsalar 1 Jun. 1987 55 p
(Contract NAS7-918)
(NASA-CR-181160; JPL-Pub-87-8; MSAT-X-144; NAS 1.26:181160) Avail: NTIS HC A04/MF A01 CSCL 17B

The performance of trellis coded multilevel differential phase-shift-keying (MDPSK) over Rician and Rayleigh fading channels is discussed. For operation at L-Band, this signalling technique leads to a more robust system than the coherent system with dual pilot tone calibration previously proposed for UHF. The results are obtained using a combination of analysis and simulation. The analysis shows that the design criterion for trellis codes to be operated on fading channels with interleaving/deinterleaving is no longer free Euclidean distance. The correct design criterion for optimizing bit error probability of trellis coded MDPSK over fading channels will be presented along with examples illustrating its application. Author

N87-25286*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRBORNE DOPPLER RADAR FOR WIND SHEAR DETECTION
Leo Staton *In its* Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 221-23 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 17E

N87-25890*# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Electrical Engineering and Computer Science.
INTEGRATION OF COMMUNICATIONS AND TRACKING DATA PROCESSING SIMULATION FOR SPACE STATION
Robert C. Lacovara *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 11 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 11 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 17B

N87-25957# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
TV EXPERIMENT IN VEGA MISSION: IMAGE PROCESSING TECHNIQUE AND SOME RESULTS
R. Z. Sagdeev, Ya. L. Ziman, A. A. Kuzmin, G. A. Avanesov, V. A. Krasikov, V. A. Shamis, V. A. Tarnopolsky, K. Szego, E. Merenyi, and B. A. Smith (Central Research Inst. for Physics, Budapest, Hungary) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 295-305 Original contains color illustrations (For primary document see N87-25908 19-90)
Copyright Avail: NTIS HC A20/MF A01; print copy avail. from EPD, ESTEC, Noordwijk, The Netherlands Dfl 175 (3 volumes)

N87-25958# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
TV EXPERIMENT IN VEGA MISSION: NUCLEUS SHAPE RECOSTRUCTION AND COMA TOMOGRAPHY. METHODS AND PRELIMINARY RESULTS
R. Z. Sagdeev, Ya. L. Ziman, G. A. Avanesov, V. I. Tarnopolsky, V. A. Krasikov, D. A. Usikov, A. S. Debabov, K. G. Sukhanov, A. Yu. Kogan, V. N. Kheifets et al. *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 307-316 Original contains color illustrations (For primary document see N87-25908 19-90)
Copyright Avail: NTIS HC A20/MF A01; print copy avail. from EPD, ESTEC, Noordwijk, The Netherlands Dfl 175 (3 volumes)

N87-25959# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
TV EXPERIMENT OF THE VEGA MISSION: PHOTOMETRY OF THE NUCLEUS AND THE INNER COMA
R. Z. Sagdeev, G. A. Avanesov, Ya. L. Ziman, V. I. Moroz, V. I. Tarnopolsky, B. S. Zhukov, V. A. Shamis, B. Smith, and I. Toth (Central Research Inst. for Physics, Budapest, Hungary) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 317-326 (For primary document see N87-25908 19-90)
Avail: NTIS HC A20/MF A01; print copy avail. from EPD, ESTEC, Noordwijk, The Netherlands Dfl 175 (3 volumes)
Avail: NTIS HC A20/MF A01; print copy avail. from EPD, ESTEC, Noordwijk, The Netherlands Dfl 175 (3 volumes)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N87-25517# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
AN ELECTROMAGNETIC IMPULSE (EMI) GENERATOR TO IMPROVE EQUIPMENT TEST RESULTS
Rudolf Harms 1986 6 p Repr. from EMC Technol., (Cleveland, Ohio), v. 37, Jul. - Aug. 1986 p 31-37
(MBB-UR-E-888/86; ETN-87-99952) Avail: Issuing Activity

A simple battery-powered electromagnetic impulse (EMI) generator was developed for spacecraft electromagnetic compatibility tests. It consists of a 74-LS-132 low power Schottky-Schmidt trigger integrated circuit operated as a multivibrator, connected to 3 output-ports: an 80 cm telescopic rod antenna; a current or magnet loop; and a voltage output. The generator offers several types of signal required for EMI emission measurements as an easy to handle single source: RE, electric fields from 2.6 kHz to greater than 300 MHz; RE, magnetic fields from 2.6 KHz to greater than 50 kHz; CE, current from 2.6 kHz to greater than 100 MHz; and CE, voltage from 2.6 kHz to greater than 100 MHz. The output signal is a rectangular pulse with a pulse repetition frequency of 2650 Hz. ESA

N87-25518# Oak Ridge National Lab., Tenn.
BASIC STUDIES OF GASES FOR FAST SWITCHES Annual Summary Report, 1 Oct. 1985 - 30 Nov. 1986
L. G. Christophorou and S. R. Hunter Feb. 1987 37 p
(Contracts N00014-82-F-0123; DE-AC05-840R-21400)
(AD-A179843) Avail: NTIS HC A03/MF A01 CSCL 09A

A summary is made of the progress during the past year on the identifications and optimization of fast gas mixtures for use in diffuse-discharge switches. Several papers describing our measurements of the key transport parameters and breakdown strength characteristics of gas mixtures which we have suggested for use in practical switching devices have been published or have been submitted for publication during the past year. During this contractual period, measurements of the basic transport and rate coefficients have been performed, i.e., the electron drift velocity, w, the electron attachment and ionization coefficient, eta/N and alpha/N, respectively, the gas ionizing W values, and the high voltage breakdown field strengths (E/N)sub iota im of gas mixtures of potential practical interest as well as studied the behavior of these gas mixtures under more severe environmental conditions which are likely to occur in practical applications. In this connection, we have continued our studies of w, eta/N, alpha/N, and k sub a (the electron attachment rate constant) as a function of gas temperature T and have initiated a new project to study the effect of gas temperature on the (E/N) iota im of selected gas mixtures. GRA

N87-25519# Air Command and Staff Coll., Maxwell AFB, Ala.
ELECTROSTATIC DISCHARGE
James F. Diehl Apr. 1987 66 p
(AD-A179847; ACSC-87-0670) Avail: NTIS HC A04/MF A01 CSCL 09A

Advances in microtechnology have resulted in electrical components with numerous advantages, including increased capability, reduced weight and size, and low operating power requirements. Unfortunately, these new microtechnology components are extremely sensitive to the damaging effects of electrostatic discharge (ESD). This study describes, in laymen's terms, ESD and the need for effective ESD controls. Emphasis is

placed on ESD controls in the Air Force. This study concludes by recommending the establishment of a comprehensive Air Force ESD control program. GRA

N87-25520# EIC, Inc., Norwood, Mass.
STUDIES OF THE FUNDAMENTALS OF SOLID-STATE BATTERIES Final Report
K. M. Abraham, M. Alamgir, and S. J. Perrotti 5 Apr. 1987 53 p
(Contract N00014-86-C-0783)
(AD-A179925) Avail: NTIS HC A04/MF A01 CSCL 10C

Studies of lithium/titanium sulfide cells utilizing polybis(methoxyethoxyethoxide phosphazene) (MEEP) based polymer electrolytes have demonstrated the excellent potential of this inorganic polymer electrolyte for use in solid-state rechargeable Li batteries of applications at or near room temperature. A major drawback of the MEEP electrolyte has been its lack of dimensional stability, manifested in its tendency to flow. This flow property prevented the preparation of thin film solid electrolytes. A solution to this problem has been found in this program by blending MEEP with poly(ethylene oxide), PEO, which resulted in novel mixed polymer electrolytes exhibiting superior mechanical stability and high conductivity. We have also developed a technique to fabricate solid-state cells with the pure MEEP electrolyte by supporting it on a thin, porous matrix comprising a fiberglass separator. GRA

N87-25521# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
MULTIDISCIPLINARY APPROACH TO THE SCIENCE AND TECHNOLOGY OF SUB-MICRON ELECTRONICS Final Report, 15 Oct. 1983 - 31 Dec. 1986
Roy Clarke 10 Mar. 1987 30 p
(Contract DAAG29-83-K-0131)
(AD-A180005; ARO-21069.17-EL) Avail: NTIS HC A03/MF A01 CSCL 20C

The final report describes research in two related focal areas: (1) Electronic properties and behavior of heterointerfaces including quantum well structures; and (2) Interfacial pattern formation and the dynamics of diffusion on fractal matter. GRA

N87-25522# Houston Univ., Tex.
DYNAMIC CONTROL OF THE INPUT IMPEDANCE OF MICROSTRIP ELEMENTS USING REACTIVE LOADS Final Report, Jan. - Sep. 1985
William F. Richards Oct. 1986 47 p
(Contract F30602-81-C-0193)
(AD-A180047; RADC-TR-86-115) Avail: NTIS HC A03/MF A01 CSCL 17I

Great effort has been expended to develop MMIC modules for active aperture phased array radar antennas, i.e., to reduce the size, complexity and cost of phased arrays for space, airborne and ground based applications. Unfortunately, a large change in element input impedance occurs when the array is scanned. To isolate the module from this change, a ferrite circulator is inserted between the module and the antenna element. The insertion of the circulator is in direct conflict with the concept of MMIC and increases the module cost because it requires the introduction of circuit elements as a separate step in the production process. This final report is a theoretical and experimental evaluation of dynamically tuning patch radiators. The results of this study show that it is possible to change the input impedance of microstrip element over a wide range without affecting its resonant frequency or coplanar pattern by moving short circuits from one point to another. Having this capability may alleviate the need for the ferrite circulators, thus reducing the size, complexity and cost of phased array antennas. GRA

N87-25523# Los Alamos National Lab., N. Mex.
TEST RESULTS OF THE LOS ALAMOS FERRITE-TUNED RF CAVITY
C. C. Friedrichs, G. Spalek, R. D. Carlini, and W. R. Smythe Mar. 1987 3 p Presented at the Particle Accelerator Conference, Washington, D.C., 16 Mar. 1987
(Contract W-7405-eng-36)
(DE87-008984; LA-UR-87-909; CONF-870302-136) Avail: NTIS HC A02/MF A01

An RF accelerating cavity appropriate for use in a 20% frequency bandwidth synchrotron has been designed, fabricated, and is now being tested at Los Alamos. The cavity-amplifier system was designed to produce a peak RF gap voltage of 90 kV over the range from 50 to 60 MHz. Special features of the system are the transversely biased ferrite tuner, capacitive coupling of the amplifier to the cavity, and a 15-cm beam pipe. High-power RF testing of the cavity-amplifier system started in August 1986, using an adjustable dc power supply to bias the ferrite. This paper describes the cavity-amplifier circuit and the test results to the present time. Future plans are also discussed. DOE

N87-25524# Allied Bendix Aerospace, Kansas City, Mo.
COPPER FOIL ADHESION WITHIN POLYIMIDE/GLASS MULTILAYER PRINTED WIRING BOARDS Final Report
J. W. Lula Apr. 1987 22 p
(Contract DE-AC04-76DP-00613)
(DE87-009100; BDX-613-3743) Avail: NTIS HC A02/MF A01

Copper foil adhesion to polyimide/glass prepreg was evaluated. Typical peel strength obtained between prepreg and the smooth side of the copper foil was 1 to 3 lb./in. width. Peel strength between prepreg and the rough side of the copper foil ranged between 6 and 7 lb./in. width. An alternate test for evaluating the integrity of multilayer printed wiring boards is described. DOE

N87-25525# Energy Research Corp., Danbury, Conn.
ZINC/AIR BATTERY R AND D. ZINC/AIR ENGINEERING ANALYSIS FOR ELECTRICAL VEHICLES, TASK 3 Final Report
M. Klein and S. Viswanathan Dec. 1986 72 p Prepared in cooperation with California Univ., Berkeley, Lawrence Berkeley Lab.
(Contract DE-AC03-76SF-00098)
(DE87-009272; LBL-22662) Avail: NTIS HC A04/MF A01

This report is an examination and analysis of the zinc-air system as the motive power source for electric vehicle propulsion. Various versions of the zinc-air system and operating schemes along with their advantages and disadvantages are discussed. Baseline cost calculations are also presented in order to compare the cost effectiveness of each of the systems. The treatise is conceptual in nature and is not based on new experimental work. DOE

N87-25526*# Texas A&M Univ., College Station. Dept. of Electrical Engineering.
ON THE SYNCHRONIZABILITY AND DETECTABILITY OF RANDOM PPM SEQUENCES
Costas N. Georghiades 1987 28 p
(Grant NAG5-778)
(NASA-CR-181125; NAS 1.26:181125) Avail: NTIS HC A03/MF A01 CSCL 09C

The problem of synchronization and detection of random pulse-position-modulation (PPM) sequences is investigated under the assumption of perfect slot synchronization. Maximum likelihood PPM symbol synchronization and receiver algorithms are derived that make decisions based both on soft as well as hard data; these algorithms are seen to be easily implementable. Bounds were derived on the symbol error probability as well as the probability of false synchronization that indicate the existence of a rather severe performance floor, which can easily be the limiting factor in the overall system performance. The performance floor is inherent in the PPM format and random data and becomes more serious as the PPM alphabet size Q is increased. A way to eliminate the performance floor is suggested by inserting special PPM symbols in the random data stream. Author

N87-25527# Naval Research Lab., Washington, D. C. Plasma Physics Div.
HIGH VOLTAGE, HIGH POWER OPERATION OF THE PLASMA EROSION OPENING SWITCH Interim Report
J. M. Neri, J. R. Boller, P. F. Ottinger, B. V. Weber (JAYCOR,

Vienna, Va.), and F. C. Young 7 Apr. 1987 10 p
(Contract DE-A108-79DP-40092)
(AD-A180182; NRL-MR-5948) Avail: NTIS HC A02/MF A01
CSCL 09A

A Plasma Erosion Opening Switch (PEOS) is used as the opening switch for a vacuum inductive storage system driven by a 1.8-MV, 1.6-TW pulsed power generator. A 135 nH vacuum inductor is current charged to about 750 kA in 50 ns through the closed PEOS which then opens in less than 10 ns into an inverse ion diode load. Electrical diagnostics and nuclear activations from ions accelerated in the diode yield a peak load voltage (4.25 MV) and peak load power (2.8 TW) that are 2.4 and 1.8 times greater than ideal matched load values for the same generator pulse.
GRA

N87-25528# Army Armament Research and Development Command, Watervliet, N. Y. Weapons Lab.
PRESSURE DEPENDENCE OF ELECTRICAL RESISTIVITY FOR MAGNESIUM-BASED AMORPHOUS ALLOYS Final Report
L. V. Meisel, P. J. Cote, T. Matsuda, and U. Mizutani Aug. 1986 25 p
(AD-A180332; ARCCB-TR-86026) Avail: NTIS HC A02/MF A01 CSCL 20C

Measured pressure coefficients of resistance and the corresponding pressure coefficients of resistivity, estimated using law of mixtures isothermal compressibility values, are reported for a series of magnesium-based amorphous alloys. The pressure coefficients correlate with the thermopower and the resistivity. When combined with results for non-magnetic amorphous alloys containing transition metals, there are suggestions of universal correlations between the pressure coefficients and the electrical resistivity. Data are discussed in the framework of the diffraction model.
GRA

N87-25529# Boeing Aerospace Co., Seattle, Wash. Automated Transportation Systems.
LINEAR SYNCHRONOUS UNIPOLAR MOTOR (LSUM) DEVELOPMENT REPORT Report, Aug. 1984 - Oct. 1986
R. G. Gilliand and G. W. Pearson Oct. 1986 232 p
(Contract DTUM60-80-C-71009)
(PB87-171591; UMTA-WA-06-0014-86-1) Avail: NTIS HC A11/MF A01 CSCL 09C

The development and test of an Integrated Magnetic Propulsion and Suspension motor is described. The machine, designated as a Linear Synchronous Unipolar Motor (LSUM), utilizes rare earth permanent magnets to supply its magnetic field, giving primary suspension for a transit vehicle without significant energy consumption. The properties of the synchronous motor allow better utilization of the vehicle power conditioning equipment by obtaining a higher power factor and efficiency product than possible with the linear induction motor. The LSUM was tested and evaluated in a static test facility. A complete documentation of life and thrust performance over the full range of a vehicle operating scenario, and a description of magnetic flux in and around the machine were obtained. The concept of supplying the unipolar magnetic field with rare earth magnets, and boosting that filed with D.C. coils for lift control was proven during the test. The motor showed its potential for use in an automated public transportation system, particularly those systems that are characterized by a relative low ratio of thrust to lift.
GRA

N87-25530# Technische Univ., Munich (West Germany). Inst. fuer Anorganisch-Chemie.
ELECTROCHEMICAL PRODUCTION OF HIGHLY CONCENTRATED OZONE USING LEAD OXIDE ANODES Ph.D. Thesis [ELEKTROCHEMISCHE ERZEUGUNG VON HOCHKONZENTRIERTEM OZON MIT BLEIDIOXID - ANODEN]
Michael Gnann 1985 232 p In GERMAN
(ETN-87-99347) Avail: NTIS HC A11

A procedure to produce very high ozone concentrations by electrolysis of water, using titanium-lead dioxide-compound anodes, was developed. High concentrations (above 20 weight percentage) are obtained at cooling-water or room temperature. A series of electrolytes and electrolyte combinations, and additives, was investigated. The formation of a fluoride-like layer on the lead-dioxide surfaces in phosphate buffet electrolytes is an essential factor in the high ozone production efficiency. Measurements show a linear dependence of the anode coating consumption on the anode current intensity. The developed pretreatment procedure of the PbO2-Ti-compound anodes does not cause potential increase. Titration and UV investigations show that ozone and peroxo-compounds are always formed simultaneously at the anode, which then only slowly react with another in phosphate solutions, resulting in high ozone production efficiency. The developed electrochemical ozone generators are technically usable.
ESA

N87-25531* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROCESSING CIRCUIT WITH ASYMMETRY CORRECTOR AND CONVOLUTIONAL ENCODER FOR DIGITAL DATA Patent
Harold J. Pfiffner, inventor (to NASA) (Hughes Aircraft Co., Culver City, Calif.) 21 Jul. 1987 11 p Filed 11 Sep. 1984 Supersedes N85-20249 (23 - 11, p 1628)
(NASA-Case-MSC-20187-1; US-Patent-4,682,343; US-Patent-Appl-SN-649327; US-Patent-Class-375-59; US-Patent-Class-371-43; US-Patent-Class-375-54; US-Patent-Class-375-76; US-Patent-Class-375-120) Avail: Issuing Activity CSCL 09C

A processing circuit is provided for correcting for input parameter variations, such as data and clock signal symmetry, phase offset and jitter, noise and signal amplitude, in incoming data signals. An asymmetry corrector circuit performs the correcting function and furnishes the corrected data signals to a convolutional encoder circuit. The corrector circuit further forms a regenerated clock signal from clock pulses in the incoming data signals and another clock signal at a multiple of the incoming clock signal. These clock signals are furnished to the encoder circuit so that encoded data may be furnished to a modulator at a high data rate for transmission.
Official Gazette of the U.S. Patent and Trademark Office

N87-25532*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL AND EXPERIMENTAL PERFORMANCE OF A DUAL-MODE TRAVELING WAVE TUBE AND MULTISTAGE DEPRESSED COLLECTOR
Peter Ramins, Dale A. Force, and Henry G. Kosmahl Aug. 1987 29 p
(NASA-TP-2752; E-3470; NAS 1.60:2752) Avail: NTIS HC A03/MF A01 CSCL 09A

A computational procedure for the design of traveling-wave-tube(TWT)/refocuser/multistage depressed collector (MDC) systems was used to design a short, permanent-magnet refocusing system and a highly efficient MDC for a medium-power, dual-mode, 4.8- to 9.6-GHz TWT. The computations were carried out with advanced, multidimensional computer programs which model the electron beam and follow the trajectories of representative charges from the radiofrequency (RF) input of the TWT, through the slow-wave structure and refocusing section, to their points of impact in the depressed collector. Secondary emission losses in the MDC were treated semiquantitatively by injecting representative secondary-electron-emission current into the MDA analysis at the point of impact of each primary beam. A comparison of computed and measured TWT and MDC performance showed very good agreement. The electrodes of the MDC were fabricated from a particular form of isotropic graphite that was selected for its low secondary electron yield, ease of machinability, and vacuum properties.
Author

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N87-25533 Iowa State Univ. of Science and Technology, Ames.
UNSTEADY FLOWS IN A SINGLE-STAGE TRANSONIC AXIAL-FLOW FAN STATOR ROW Ph.D. Thesis
Michael Dale Hathaway 1986 214 p
Avail: Univ. Microfilms Order No. DA8703709

Detailed measurements of the unsteady velocity field within the stator flow of a transonic axial-flow fan were acquired using a laser anemometer. They were obtained on axisymmetric surfaces located at 10 and 50 percent span from the shroud, with the fan operating at maximum efficiency at design speed. The ensemble-average and variance of the measured velocities are used to identify rotor-wake-generated (deterministic) unsteadiness and turbulence, respectively. Correlations of both deterministic and turbulent velocity fluctuations provide information on the characteristics of unsteady interactions within the stator row. These correlations are derived from the Navier-Stokes equation in a manner similar to deriving the Reynolds stress terms, whereby various averaging operators are used to average the aperiodic, deterministic, and turbulent velocity fluctuations known to be present in multistage turbomachines. The correlations of deterministic and turbulent velocity fluctuations throughout the axial fan stator row are presented. In particular, amplification and attenuation of both types of unsteadiness are shown to occur within the stator blade passage. Dissert. Abstr.

N87-25534# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
DEVELOPMENT OF A GEOMETRY HANDLING PROGRAM FOR THE FFA SUBSONIC HIGHER ORDER PANEL METHOD
Lars G. Tysell Oct. 1986 43 p Sponsored by the Swedish Board for Technical Development
(Contracts FFA-AU-Proj-1731:1; FFA-AU-Proj-1801:1; FFA-AU-Proj-1881:1; FFA-AU-Proj-2041:1; FFA-AU-Proj-2240)
(FFA-TN-1985-48; ETN-87-99778) Avail: NTIS HC A03/MF A01

A program that simplifies the geometry input procedure to a subsonic higher order panel program, for a complete aircraft is described. All necessary programs were coupled together to a system. A fast equation solver was developed. A user's manual to the whole program system is given. Pressure distributions for a wing-fuselage configuration test case are presented. The agreement between the measurement and the calculation is very good. ESA

N87-25535# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
THREE DIMENSIONAL AND TWO DIMENSIONAL SOLUTIONS OF THE QUASI-CONSERVATIVE EULER EQUATIONS
C. Weiland and M. Pfitzner 1986 7 p Presented at the 10th International Conference on Numerical Methods in Fluid Dynamics, Beijing, China, 26 Jun. 1986
(MBB-UR-915/86; ETN-87-99945) Avail: Issuing Activity

Two and three dimensional calculations of inviscid and transonic flows around bodies and through nozzles are presented. The method is based on the integration of the unsteady Euler equations formulated quasi-conservatively. A finite difference scheme with split-matrix upwind biased discretization, which is third order accurate in space is employed. Explicit first order time marching with local time steps is used. Flows about bodies at Mach numbers greater than 2 are calculated with a front shock fitting version of the code. It is shown that the scheme can capture shocks and vortex sheets. ESA

N87-25536# McDonnell Aircraft Co., St. Louis, Mo.
VISCID/INVISCID SEPARATED FLOWS Final Report, Sep. 1983 - Mar. 1986
T. Cebeci, K. C. Chang, R. W. Clark, D. P. Mack, and S. M. Schimke Jul. 1986 94 p
(Contract F33615-83-C-3026)
(AD-A179858; MDC-J3968; AFWAL-TR-86-3048) Avail: NTIS HC A05/MF A01 CSCL 20D

A method has been developed for calculating subsonic three-dimensional flows over fighter aircraft configurations at flow conditions including separation. The method employs a viscid inviscid interaction approach, with a panel method used for the inviscid analysis and a finite difference boundary layer method for the viscous analysis. The viscid and inviscid analyses are coupled using an interactive technique based on inverse boundary layer theory. This approach allows efficient calculation of flows with large separation regions, including both leading and trailing edge separations. The method was validated on three fighter aircraft geometries and comparisons with test data are presented. GRA

N87-25537# Sandia National Labs., Albuquerque, N. Mex.
NACHOS 2: A FINITE ELEMENT COMPUTER PROGRAM FOR INCOMPRESSIBLE FLOW PROBLEMS. PART 1: THEORETICAL BACKGROUND
D. K. Gartling Apr. 1987 77 p
(Contract DE-AC04-76DP-00789)
(DE87-008400; SAND-86-1816-Pt-1) Avail: NTIS HC A05/MF A01

The theoretical and numerical background for the finite element computer program, NACHOS 2, is presented in detail. The NACHOS 2 code is designed for the two-dimensional analysis of viscous incompressible fluid flows, including the effects of heat transfer and/or other transport processes. A general description of the boundary value problems treated by the program is presented. The finite element formulations and the associated numerical methods used in the NACHOS 2 code are also outlined. Instructions for use of the program are documented in SAND-86-1817; examples of problems analyzed by the code are provided in SAND-86-1818. DOE

N87-25538# Sandia National Labs., Albuquerque, N. Mex.
INFLUENCE OF A HEATED LEADING EDGE ON BOUNDARY LAYER GROWTH, STABILITY AND TRANSITION
D. B. Landrum and J. M. Macha 1987 11 p Presented at the 19th Fluid Dynamics, Plasma Dynamics and Laser Conference, Honolulu, Hawaii, 8 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-008516; SAND-86-2718C; CONF-870622-3) Avail: NTIS HC A02/MF A01

This paper presents the results of a combined theoretical and experimental study of the influence of a heated leading edge on the growth, stability, and transition of a two-dimensional boundary layer. The findings are directly applicable to aircraft wings and nacelles that use surface heating for anti-icing protection. The potential effects of the non-adiabatic condition are particularly important for laminar-flow sections where even small perturbations can result in significantly degraded aerodynamic performance. The results of the study give new insight to the fundamental coupling between streamwise pressure gradient and surface heat flux in laminar and transitional boundary layers. DOE

N87-25539# Los Alamos National Lab., N. Mex.
TURBULENCE
F. H. Harlow Apr. 1987 22 p Presented at the DNA Numerical Methods Symposium, Menlo Park, Calif., 28 Apr. 1987
(Contract W-7405-eng-36)
(DE87-008993; LA-UR-87-1235; CONF-8704109-1) Avail: NTIS HC A02/MF A01

Current theories for material mixing include multiphase interpenetration and single-field turbulence transport with large density variations. Neither approach by itself is adequate for current problem-solving needs, but in combination they offer tremendous opportunities for the analysis of complex material dynamics.

Multiphase theory contributes the ordered jets or particulate trajectories that penetrate in wave-like fashion; turbulence transport superimposes the important nonlinear diffusive component to the mixing. Shear impedance and energy transport arise naturally in this combined analysis. DOE

N87-25540# Dayton Univ., Ohio.
THE INITIAL STAGE OF WAKE DEVELOPMENT IN LINEARIZED INCOMPRESSIBLE AND COMPRESSIBLE FLOW Interim Report, May - Aug. 1986
Karl G. Guderley Mar. 1987 45 p
(Contract F33615-86-C-3200)
(AD-A180193; UDR-TR-86-94; AFWAL-TR-86-3120) Avail: NTIS HC A03/MF A01 CSCL 20D

This report investigates the initial stage of the wake formation in linearized incompressible or compressible subsonic flows after a change of the upwash at the wing in the form of a step function in time. By a superposition of solutions of this kind all other changes of the upwash at the wing can be treated. The potential due to the above perturbation can be expressed by a circulation-free flow that satisfies the boundary condition imposed by the sudden change of upwash and the potential due to the wake vortices which leaves the boundary conditions unchanged. The latter is expressed by a superposition of the potentials due to individual vortices emanating from the trailing edge at different times and traveling downstream with the free stream velocity. The intensity of these vortices is determined by the Kutta condition, namely that at the trailing edge and at all times the upwash in the wake obtained by the combination of circulation-free flow and wake vortices be finite. In the incomprehensible flow case the analysis can be carried out in all details. In the comprehensible case the flow fields needed can be described by similarity solutions, but of a rather complex character. The feature essential for the present problem, namely the upwash singularity at the trailing edge can, however, be gleaned by a discussion in general terms so that one can determine the vortex distribution within the wake except for one constant factor. GRA

N87-25541# Minnesota Univ., Minneapolis. Hydraulic Lab.
RESEARCH PROGRAM IN HYDROACOUSTICS Final Technical Report
Roger E. Arndt, Hiroshi Higuchi, Mostafa Kaveh, Robert Lambert, and Robert Plunkett Apr. 1987 157 p
(Contract N00014-83-K-0145)
(AD-A180312; Rept-254) Avail: NTIS HC A08/MF A01 CSCL 20D

This program is concerned with the nature of the low wavenumber characteristics of turbulent boundary layer pressure fluctuations including their relationship with structural vibration, and cavitation noise from tip vortices. There are four major tasks: (1) development of signal analysis techniques that permit accurate estimates of the low wavenumber portion of the wavenumber frequency pressure spectrum; (2) measurement of the pressure spectrum and comparison of experiment with a theoretical wave guide model; (3) determination of the structural response to wall layer pressure fluctuations and the influence of plate vibration on the structure of turbulence within the boundary layer; and (4) measurement of the spectral characteristics and source distribution of cavitation noise in tip vortices in steady and nonsteady flow. GRA

N87-25542# Washington Univ., Seattle. Lab. for Chemometrics.
APPLICATIONS OF A VERSATILE INJECTION VALVE FOR FLOW INJECTION ANALYSIS Interim Technical Report
Brice C. Erickson, Bruce R. Kowalski, and Jarda Ruzicka 1 Apr. 1987 19 p
(Contract N00014-75-C-0536)
(AD-A180432; TR-36) Avail: NTIS HC A02/MF A01 CSCL 07C

Most flow injection analysis work involves a simple injection of sample into a flowing stream of reagent or carrier, generally accomplished by using a standard six-port injection valve. A number of applications, however, involve the simultaneous injection of sample with reagent, interferent or standard. Various configurations of a singie valve are shown which may be useful in a number of these techniques. GRA

N87-25543*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BOUNDARY-LAYER STABILITY ANALYSIS FOR SHARP CONES AT ZERO ANGLE-OF-ATTACK Final Report, Jun. 1982 - Feb. 1986
Leslie M. Mack Aug. 1986 52 p
(Contract NAS7-918; AF Proj. 2307)
(NASA-CR-181139; NAS 1.26:181139; AD-A180610; AFWAL-TR-86-3022) Avail: NTIS HC A04/MF A01 CSCL 20D

The stability characteristics of an uncooled sharp cone at zero angle of attack have been calculated at an edge Mach number of 6.8 and a stagnation temperature of 728 K (1310 R) using spatial normal modes. Transformed flat-plate boundary-layer profiles were used for the mean flow. By a consideration of both two-dimensional and oblique waves, it has been determined that instability at this Mach number is primarily a two-dimensional second-mode instability. Comparisons with available stability experiments show that the calculated unstable frequencies were present in the experiments, but the measured amplification rates differ from the calculated. A band of unstable high frequencies above the second-mode region that starts at about R=1400 is not accounted for by the theory. Comparisons of amplitude-growth curves for both cones and flat plates at Mach numbers 4.5, 5.8 and 6.8 show that the most unstable normal modes on a cone have at least as much total growth as on a flat plate at Mach 4.5 and more total growth at the other two Mach numbers. GRA

N87-25544# Georgia Inst. of Tech., Atlanta.
MERGING BUOYANT JETS IN A STRATIFIED CROSSFLOW
P. J. W. Roberts and W. H. Snyder Mar. 1987 14 p Sponsored by EPA
(PB87-167037; EPA-600/D-87-056) Avail: NTIS HC A02/MF A01 CSCL 20D

Some of the results of an extensive series of experiments to study the characteristics of merging, horizontally discharged buoyant jets in a linearly density stratified current are summarized. The experiments were conducted in a towing tank to simulate conditions typical of ocean outfalls. The most important source parameter affecting dilution was found to be the buoyancy flux per unit length (b) and the effect of the current speed (u) is expressed by the ratio F = cu u/b. Dilution is unaffected by current for F less than 0.1, but thereafter increases with current speed as the rise height decreases. GRA

N87-25545*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PLUME DISPERSION OF THE EXHAUST FROM A CRYOGENIC WIND TUNNEL
William S. Lassiter Jun. 1987 29 p
(NASA-TM-89148; NAS 1.15:89148) Avail: NTIS HC A03/MF A01 CSCL 20D

An analytical model was developed to predict the behavior of the plume exhausting from the cryogenic National Transonic Facility. Temperature, visibility, oxygen concentration, and flow characteristics of the plume are calculated for distance downwind of the stack exhaust. Negative buoyancy of the cold plume is included in the analysis. Compared to photographic observations, the model predicts the centerline trajectory of the plume fairly accurately, but underpredicts the extent of fogging. The diffusion coefficient is revised to bring the model into better agreement with observations. Author

N87-25546*# California Univ., Los Angeles.
NUMERICAL SOLUTION OF THE UNSTEADY NAVIER-STOKES EQUATION Semiannual Report
Stanley J. Osher and Bjoern Engquist 1985 61 p
(Grant NAG1-506)
(NASA-CR-181173; NAS 1.26:181173) Avail: NTIS HC A04/MF A01 CSCL 20D

(NASA-CR-181173; NAS 1.26:181173) Avail: NTIS HC A04/MF A01 CSCL 20D

The construction and the analysis of nonoscillatory shock capturing methods for the approximation of hyperbolic conservation laws are discussed. These schemes share many desirable properties with total variation diminishing schemes, but TVD schemes have at most first-order accuracy, in the sense of truncation error, at extrema of the solution. In this paper a uniformly second-order approximation is constructed, which is nonoscillatory in the sense that the number of extrema of the discrete solution is not increasing in time. This is achieved via a nonoscillatory piecewise linear reconstruction of the solution from its cell averages, time evolution through an approximate solution of the resulting initial value problem, and averaging of this approximate solution over each cell. Author

N87-25503# Joint Publications Research Service, Arlington, Va.
MOTION OF BODY IN VIBRATING FLUID
B. A. Lugovtsov and V. L. Sennitskiy *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 68 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 289, no. 2, 1986 p 314-317 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

N87-25889*# South Carolina State Coll., Orangeburg. Dept. of Mathematics and Computer Science.
GEOMETRIC DESCRIPTION AND GRID GENERATION FOR SPACE VEHICLES
Madakasira G. Krishna *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 16 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 16 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N87-25547*# Eikontech Ltd., Sheffield (England).
REPORT ON HOLOGRAPHIC TESTS AT S-BAND AND K-BAND ON THE DSS-63 64 METRE ANTENNA Final Report, 18-29 May 1985
M. P. Godwin, E. P. Schoessow, and P. J. Richards Feb. 1986 98 p
(Contract JPL-956984)
(NASA-CR-181083; NAS 1.26:181083; Rept-A087) Avail: NTIS HC A05/MF A01 CSCL 14B

High resolution holographic tests were carried out on DSS-63 at S-band and K-band during May 1985. These tests followed a mechanical retrofit which involved the addition of structural bracing to the backing structure. Geosynchronous satellite beacons were used as sources for the tests. At a resolution of 0.4m the S-band and K-band tests revealed rms deviations of the surface to be 2.73mm and 1.53mm, respectively. The difference between these two results is thought to be due mainly to contamination of the S-band surface error map by expected and generally predictable subreflector diffraction effects. The S-band map is also known to be contaminated by diffraction from the subreflector support struts and has a higher noise level than the K-band map. A list of corrections to be applied to the reflector panels is derived from the K-band map. These corrections are predicted to reduce the rms deviation from 1.53mm to 0.86mm at 0.4m resolution. Comparison with results obtained before the mechanical retrofit suggests the major effect of the added structural bracing to be reduction of a third order deformation of the reflector about its axis. Author

N87-25548# Bundesforschungsanstalt fuer Landeskunde und Raumordnung, Bonn (West Germany).
AERIAL-PHOTOGRAPHY SUPPORTED INVENTORY IN THE DEVELOPMENT OF LOCAL AND REGIONAL ENERGY SUPPLY CONCEPTS [LUFTBILDGESTUETZTE BESTANDSAUFNAHME BEI DER ENTWICKLUNG OERTLICHER UND REGIONALER ENERGIEVERSORGUNDSKONZEPTE]
Gerhard Assenmacher, Horst Breunig, Walter Dittrich, Ulrich Eisenburger, Cordelia Koehler, Gerhard Marx, Helmut Pollack, Holger Ried, Manfred Schramm, and Klaus-Dieter Tarlowski 1985 136 p In GERMAN
(ISBN-3-87994-656-6; ETN-87-99664) Avail: NTIS HC A07/MF A01

An inventory of the energy demand and energy offer structure was made using aerial photographs, in an energy program on the development of local and regional energy supply concepts. Improved inventory methods were developed and tested using long-range ground reconnaissance. Evaluation of photographic and thermographic aerial pictures as well as their combination with each other and with the known short-range ground reconnaissance method, were assessed. ESA

N87-25549# Gordon Research Conferences, Inc., Kingston, R.I.
GORDON RESEARCH CONFERENCE ON HOLOGRAPHY AND OPTICAL INFORMATION PROCESSING (1987) Final Report
Steven K. Case Feb. 1987 13 p Conference held in Santa Barbara, Calif., 5-9 Jan. 1987
(Grant AF-AFOSR-0135-87)
(AD-A179703; AFOSR-87-0551TR) Avail: NTIS HC A02/MF A01 CSCL 20F

The field of Holography and Optical Information Processing is an important and active one with many significant advances during the past twenty years. This conference had 19 formal talks describing the most recent areas of interest. The conference contained a carefully selected mixture of talks including optical computing, components and architectures; optical processors; holography; and applications of coherent light. GRA

N87-25550# Aerodyne Products Corp., Billerica, Mass.
PORTABLE FUEL LEAK DETECTOR Final Report, 1 Jul. 1986 - 1 Jan. 1987
Burton D. Figler Jan. 1987 37 p
(Contract F33615-86-C-2652)
(AD-A180095; AFWAL-TR-87-2021) Avail: NTIS HC A03/MF A01 CSCL 01C

Aerodyne Products Corp. successfully met the objective of this program by the development of a device for measurement of fuel leaks in aircraft. This device satisfies the two requirements: (1) monitor enclosed bays for fuel leaks, and (2) measure the fuel leak rate. The first application requires a rugged, reliable and inexpensive device that can be mounted in aircraft bays, continuously monitoring for fuel leaks. The second application uses the same device with a battery attachment for ease in handling by personnel to measure fuel leak rates. In this Phase I SBIR program, tests were performed with a breadboard spectral correlation device to determine detection sensitivity and to develop techniques for fuel leak measurements. The device determines the presence of fuel vapor in air by measuring the absorption of infrared radiation by the vapor. Air to be analyzed is drawn into an absorption cell. The device was calibrated with decane and can observe vapor down to 1 part per million. Fuels have the same infrared absorption band. Measurements were made of the leak rate from an aluminum sheet with a 6 mil pinhole. An air sampling tube was placed above the leak, drawing air through the absorption cell. GRA

N87-25551# Mound Lab., Miamisburg, Ohio.
CONTROLLING FIRING CHARACTERISTICS OF HOT-WIRE DEVICES WITH THE USE OF ELECTROTHERMAL RESPONSE PARAMETER SCREENING
A. C. Munger 1986 10 p Presented at the 13th Symposium on Explosives and Pryotechnics, Hilton Head Island, S.C., 2 Dec. 1986
(Contract DE-AC04-76DP-00053)
(DE87-004212; MLM-3412(OP); CONF-861230-5) Avail: NTIS HC A02/MF A01

Many hot-wire components that are manufactured for the Department of Energy have, as part of the acceptance criteria, the requirement that the units be screened for the bridgewire thermal conductance factor. The screening has reduced the data scatter for no-fire results and helped raise the no-fire level of a given population by removing units with poor conductance. The bridgewire geometry and location can be verified by monitoring the thermal conductance. The control of the bridgewire leads to better uniformity of the loaded component. The all-fire level for a particular component is largely controlled by the pyrotechnic compacted around it. The density of the pyrotechnic can be monitored by measuring the thermal conductance of the wire-powder surface. DOE

N87-25552*# United Technologies Research Center, East Hartford, Conn.
ADVANCED HIGH TEMPERATURE STATIC STRAIN SENSOR DEVELOPMENT Final Report
C. O. Hulse, K. A. Stetson, H. P. Grant, S. M. Jameikis, W. W. Morey, P. Raymondo, T. W. Grudkowski, and R. S. Bailey Aug. 1986 205 p
(Contract NAS3-22126)
(NASA-CR-179520; NAS 1.26:179520; R86-995875-28) Avail: NTIS HC A10/MF A01 CSCL 14B

An examination was made into various techniques to be used to measure static strain in gas turbine liners at temperatures up to 1150 K (1600 F). The methods evaluated included thin film and wire resistive devices, optical fibers, surface acoustic waves, the laser speckle technique with a heterodyne readout, optical surface image and reflective approaches and capacitive devices. A preliminary experimental program to develop a thin film capacitive device was dropped because calculations showed that it would be too sensitive to thermal gradients. In a final evaluation program, the laser speckle technique appeared to work well up to 1150 K when it was used through a relatively stagnant air path. The surface guided acoustic wave approach appeared to be interesting but to require too much development effort for the funds available. Efforts to develop a FeCrAl resistive strain gage system were only partially successful and this part of the effort was finally reduced to a characterization study of the properties of the 25 micron diameter FeCrAl (Kanthal A-1) wire. It was concluded that this particular alloy was not suitable for use as the resistive element in a strain gage above about 1000 K. Author

N87-25553# Ballistic Research Labs., Aberdeen Proving Ground, Md.
X-RAY TOPOGRAPHY UTILIZING NON-EQUATORIAL REFLECTIONS Final Report, 25 Sep. 1984 - 6 Jun. 1986
P. W. Kingman Mar. 1987 25 p
(DA Proj. 1L1-61101-A-91-A)
(AD-A180233; BRL-TR-2789) Avail: NTIS HC A02/MF A01 CSCL 14E

A technique for back reflection topography has been developed which uses nonequatorial reflections. The geometry of back reflection topography is analyzed in a general way, and it is shown how this analysis can be used for systematic imaging and contrast strategies. A novel camera design based upon this approach is also presented. GRA

N87-25554# Spectron Development Labs., Inc., Costa Mesa, Calif.
HOLOGRAPHIC DETECTION OF LATENT DEFECTS Final Report, Aug. 1984 - Mar. 1986
K. A. Arunkumar and J. D. Trolinger Oct. 1986 87 p
(Contract F33615-84-C-3403)
(AD-A180436; SDL-86-2406-15F; AFWAL-TR-86-3055) Avail: NTIS HC A05/MF A01 CSCL 14D

This project was aimed at seeing whether holographic interferometry (H.I.) could be used in evaluation standard environmental stress screening methods currently used to select and qualify printed circuit boards (PCB). To do that it should be proven that H.I. is capable of detecting defects in a PC board that have been brought about by the stress screening procedures. Hence, the objectives of this project were to determine: (1) if holographic interferometry can identify the most common circuit board defects before the components fail (component failure due to internal flaws excluded); (2) if holographic interferometry can locate defects which have evolved into failure; and (3) if holographic interferometry can locate and detect the onset of defects on PC boards (sensitivity). To achieve the objectives, introduced defects and defects induced by thermal and vibrational stressing were used in the study. Defect identification was through the perturbations in the H.I. fringes on the boards. Some of the defects were detected when the circuits were electrically functional. These defects were solder cracks (cuts), partial trace separation and trace separation at solder joints. H.I. also succeeded in revealing components that have been disconnected either through snipping or desoldering. GRA

N87-25555*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FOUR-TERMINAL ELECTRICAL TESTING DEVICE Patent Application
Robert L. Robinson, inventor (to NASA), Thomas J. Graves, inventor (to NASA), and William C. Hoffman, III, inventor (to NASA) 1 Apr. 1987 17 p
(NASA-Case-MSC-21166-1; US-Patent-Appl-SN-032685) Avail: NTIS HC A02/MF A01 CSCL 14B

The invention relates to a four-terminal electrical connector device for testing and measuring unknown resistances of initiators used for starting pyrotechnic events aboard the space shuttle. The testing device minimizes contact resistance degradation effects and so improves the reliability of resistance measurements taken with the device. Separate and independent voltage sensing and current supply circuits each include a pair of socket contacts for mating engagement with the pins of the initiator. The unknown resistance that is measured by the device is the resistance of the bridgewire of the initiator which is required to be between 0.95 and 1.15 ohms. NASA

N87-25556*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
BEARING BYPASS MATERIAL TESTING SYSTEM Patent Application
John H. Crews, Jr., inventor (to NASA) 12 Feb. 1987 9 p
(NASA-Case-LAR-13458-1; NAS 1.71:13458-1; US-Patent-Appl-SN-013802) Avail: NTIS HC A02/MF A01 CSCL 14B

A material specimen containing a central hole is bolted between two bearing guide plates. An applied load control exerts an applied load, either tension or compression, to one end of the specimen and a bypass load control applies a bypass load to the other end of the specimen. Both load controls have their control inputs supplied by a single input signal generator. The difference between the applied load and the bypass load is transmitted through the bolt and plates to the bearing load cells. NASA

N87-25557*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LIGHTWEIGHT TENSILE SPECIMEN GRIPS Patent Application
William G. Witte, Jr., inventor (to NASA) and Walter D. Gibson, inventor (to NASA) 3 Mar. 1987 14 p
(NASA-Case-LAR-13461-1; NAS 1.71:LAR-13461-1; US-Patent-Appl-SN-022305) Avail: NTIS HC A02/MF A01 CSCL 14B

A test specimen grip assembly is described which includes a pair of test grips formed from a jaw member, a pair of hardened wedges, and a tightening device. The jaw member has a mouth and a U-shaped central opening with a base, wider than the mouth, and sides sloping from the base to the mouth. The tightening device has a first block for exerting pressure against the base of the U-shaped central opening, a second block for exerting pressure against the rear surfaces of the wedges, and a pressure controller for controlling the pressure exerted by the blocks. The test specimen grip assembly also includes a back plate with a longitudinal axis and clamps for clamping the pair of test grips onto the back plate with the center lines of the test grips aligned parallel to the longitudinal axis of the back plate. NASA

N87-25558*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MINIATURE REMOTE DEAD WEIGHT CALIBRATOR Patent Application
Frank H. Supplee, Jr., inventor (to NASA) and Tcheng Ping, inventor (to NASA) 30 Apr. 1987 13 p
(NASA-Case-LAR-13564-1; US-Patent-Appl-SN-044180) Avail: NTIS HC A02/MF A01 CSCL 14B

The invention is a miniature, remote, computer-controlled dead weight calibrator. This device which is comprised of an interlocking rod and dead weight assembly, a motorized lifting mechanism, a controller, and a microcomputer, allows automatic calibration of force transducers needed for wind tunnel operations while the transducers are located within a cryogenic chamber. The operation of a cryogenic transonic wind tunnel requires calibration of force transducers at cryogenic operating temperatures. The invention allows remote, automatic, and sequential loading and unloading of preselected weights. NASA

N87-25559*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
POROUS PLUG FOR REDUCING ORIFICE INDUCED PRESSURE ERROR IN AIRFOILS Patent Application
Elizabeth B. Plentovich, inventor (to NASA), Blair B. Gloss, inventor (to NASA), John W. Eves, inventor (to NASA), and John P. Stack, inventor (to NASA) 5 Feb. 1987 12 p
(NASA-Case-LAR-13569-1; US-Patent-Appl-SN-010943) Avail: NTIS HC A02/MF A01 CSCL 14B

A porous plug is provided for the reduction or elimination of positive error caused by orifice during static pressure measurements of airfoils. The porous plug is press fitted into the orifice, thereby preventing the error caused either by fluid flow turning into the exposed orifice or by the fluid flow stagnating at the downstream edge of the orifice. In addition, porous plug is flushed with the outer surface of airfoil, as by filing and polishing, to provide a smooth surface which alleviates error caused by imperfections in the orifice. Porous plug is preferably made of sintered metal, which allows air to pass throught the pores, so that static pressure measurements can be made by remote transducers. NASA

N87-25560# National Oceanic and Atmospheric Administration, Washington, D. C. Special Projects Div.
PLANNING FOR FUTURE OPERATIONAL SENSORS AND OTHER PRIORITIES
James C. Fischer, ed., Walter Planet, Larry Stowe, and William L. Smith Jun. 1987 50 p
(NOAA-NESDIS-30) Avail: NTIS HC A03/MF A01

The study programs established by the National Environmental Satellite, Data, and Information Service (NESDIS) Office of Systems Development for polar orbiting and geostationary platform sensors are defined. The main thrust of the studies is to prepare an operational payload for the polar platform portion of the space station program. The Advanced Medium Resolution Infrared Radiometer (AMRIR) will be a replacement for the Advanced Very High Resolution Radiometer (AVHRR) and the High Resolution Infrared Radiometer Sounder (HIRS), now operational on the NOAA series of polar orbiters. The Global Ozone Monitoring Radiometer (GOMR) will replace the Solar Backscatter Ultraviolet (SBUV) on the polar platform as the operational ozone monitor. A series of geostationary environmental satellites, beginning with GOES-I, will offer improved image products and operate the first operational sounder from a geostationary satellite. Plans directed towards the development of other sensors are discussed and programs to support microwave science investigations are described. M.G.

N87-25561*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VAPOR FRAGRANCER Patent Application
Q. Tran Sang, inventor (to NASA) and Timothy D. Bryant, inventor (to NASA) 22 May 1987 9 p
(NASA-Case-LAR-13680-1; US-Patent-Appl-SN-052941) Avail: NTIS HC A02/MF A01 CSCL 14B

This invention relates to a vapor fragrancer for continuously, uniformly, and economically odorizing or deodorizing an environment. Homes, offices, automobiles, and space stations require either odorizing or deodorizing of the atmosphere to create pleasant conditions for work or leisure. A vapor fragrancer is provided to accomplish these goals. A supplier continuously supplies a predetermined amount of desired liquid fragrance from a container to a retaining material, which is positioned in the circulation path of the atmosphere. The supplier is either a low powered pump or a gravity dispenser. The atmosphere flowing in a circulation path passes over the retaining material containing the liquid fragrance and lifts a fragrant vapor from the retaining material. The atmosphere is thereby continuously and uniformly fragranced. NASA

N87-25562*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AMPLITUDE SPECTRUM MODULATION TECHNIQUE FOR ANALOG DATA PROCESSING IN FIBER OPTIC SENSING SYSTEM WITH TEMPORAL SEPARATION OF CHANNELS
Grigory Adamovsky 1987 10 p Presented at the O-E/Fibers '87 Symposium on Fiber Optics and Integrated Optoelectronics, San Diego, Calif., 16-21 Aug. 1987; sponsored by SPIE and International Society for Optical Engineering
(NASA-TM-100152; E-3714; NAS 1.15:100152) Avail: NTIS HC A02/MF A01 CSCL 14B

A novel technique to analyze analog data in fiber optic sensing systems with temporal separation of channels is proposed. A theoretical explanation of the process is presented and an experimental setup that was used to obtain data is described. Author

N87-25502# Joint Publications Research Service, Arlington, Va.
ACOUSTIC CONTINUITY TRANSDUCER FOR FLOW METERS OPERATING IN TWO-PHASE MEDIA
A. A. Alekseyev and A. L. Seyfer *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 67 Transl. into ENGLISH from Izmeritelnaya Tekhnika (Moscow, USSR), no. 4, Apr. 1986 p 42-43 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

N87-25964# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
OBSERVATIONS BY THE HALLEY MULTICOLOR CAMERA
H. U. Keller, C. Arpigny, C. Barbieri, R. M. Bonnet, S. Cazes, M. Coradini, C. B. Cosmovici, W. Curdt, W. A. Delamere, W. F. Huebner (Los Alamos Scientific Lab., N. Mex.) et al. *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 347-350 Sponsored by NASA, BMFT, Max-Planck-Gesellschaft, DFVLR, CNES, SPPS and CNR (For primary document see N87-25908 19-90)
Copyright Avail: NTIS HC A20/MF A01; print copy avail. from EPD, ESTEC, Noordwijk, The Netherlands Dfl 175 (3 volumes)

36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

N87-25563# Los Alamos National Lab., N. Mex.
AN OPTICALLY PUMPED POLARIZED ION SOURCE FOR LAMPF
R. L. York, M. Dulick, W. D. Cornelius, and O. B. vanDyck 1987 6 p Presented at the International Workshop Hadron Facility Technology, Santa Fe, N. Mex., 2 Feb. 1987
(Contract W-7405-eng-36)
(DE87-007470; LA-UR-87-700; CONF-870260-3) Avail: NTIS HC A02/MF A01

The status of the three operational optically pumped polarized H^- sources is reviewed. The optically pumped polarized H^- source development program at LAMPF is discussed. Aspects of this type of source requiring further research and development are discussed. DOE

N87-25564# Lawrence Livermore National Lab., Calif.
HIGH GAIN FREE ELECTRON LASER FOR HEATING AND CURRENT DRIVE IN THE ALCATOR-C TOKAMAK
R. A. Jong and E. T. Scharlemann 1986 22 p Presented at the 8th International Free Electron Laser Conference, Glasgow, Scotland, 1 Sep. 1986
(Contract W-7405-eng-48)
(DE87-008486; UCRL-94845; CONF-8609131-11) Avail: NTIS HC A02/MF A01

The free electron laser (FEL) particle simulation code, FRED, has been used to examine the design of an FEL for amplifying radiation in the one to two millimeter wavelength range for use in electron heating and current drive in a Tokamak device such as ALCATOR-C. As a desired design goal a peak output power of 8 GW, with a minimum input power in the 1 to 100 watt range has been used. The effects of electron beam current, energy and brightness, laser frequency and input power as well as wiggler wavelength and overall wiggler length on the performance of the FEL have been examined. DOE

N87-25565# Washington Univ., Seattle. Dept. of Applied Mathematics.
FREE ELECTRON LASERS WITH VARIABLE PARAMETER WIGGLERS: A STRICTLY NONLINEAR OSCILLATOR WITH SLOWLY VARYING PARAMETERS Ph.D. Thesis
Yiping Li Apr. 1987 171 p
(Contract DE-FG06-86ER-25019)
(DE87-008935; DOE/ER-25019/3; TR-87-2) Avail: NTIS HC A08/MF A01

The first part of this dissertation gives a detailed mathematical modeling of free electron lasers (FEL), and the second part is a study of a number of general perturbation methods for solving FEL and other systems. A dimensionless model of the motion of electrons in FEL is derived and secular effects due to slow variations in the magnetic field amplitude of the wiggler, and the effect of the density of electrons on the rate of evolution of the signal field are systematically accounted for. The mathematical problem reduces to the analysis of a strictly nonlinear oscillator with slowly varying parameters and small perturbation terms. Two distinguished limits governing the rate of variation of the wiggler, and three distinguished limits governing the evolution of the signal field are identified. To analyze solutions of FEL and other strictly nonlinear systems, the method of Kuzmak-Luke and the method of averaging are reviewed and extended. It is shown that both methods are equivalent. In order to implement the calculation of explicit solutions, two approximation schemes are developed. DOE

N87-25566# Hughes Aircraft Co., Albuquerque, N. Mex.
FREQUENCY LOCKING IN COUPLED FREE ELECTRON LASERS
Weng W. Chow, Q. D. Appert, A. C. Saxman, B. McVey, and S. C. Bender 1987 12 p Presented at the 19th Fluid Dynamics, Plasma Dynamics and Laser Conference, Honolulu, Hawaii, 8 Jun. 1987 Prepared in cooperation with Los Alamos National Lab., N. Mex.
(Contract W-7405-eng-36)
(DE87-009001; LA-UR-87-1347; CONF-870622-4) Avail: NTIS HC A02/MF A01

The application of optical phased arrays to obtain high output power, beam agility, and large equivalent output aperture has received considerable interest. In this paper, we investigate the scaling of free electron lasers using the phased array concept. DOE

N87-25567* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND MEANS FOR GENERATION OF TUNABLE LASER SIDEBANDS IN THE FAR-INFRARED REGION Patent
Herbert M. Pickett, inventor (to NASA) and Jam Farhoomand, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 21 Jul. 1987 8 p Filed 3 Oct. 1985 Supersedes N86-20779 (24 - 11, p 1780)
(NASA-Case-NPO-16497-1-CU; US-Patent-4,682,053; US-Patent-Appl-SN-783887; US-Patent-Class-307-425; US-Patent-Class-372-4; US-Patent-Class-372-20; US-Patent-Class-372-69; US-Patent-Class-372-99) Avail: US Patent and Trademark Office CSCL 20E

A method for generating tunable far-infrared radiation is described. The apparatus includes a Schottky-barrier diode which has one side coupled through a conductor to a waveguide that carries a tunable microwave frequency; the diode has an opposite side which is coupled through a radiating whisker to a bias source. Infrared light is directed at the diode, and infrared light with tunable sidebands is radiated by the whisker through an open space to a reflector. The original infrared is separated from a tunable infrared sideband by a polarizing Michelson interferometer.
Official Gazette of the U.S. Patent and Trademark Office

N87-25568# National Bureau of Standards, Boulder, Colo. Quantum Physics Lab.
DETECTION OF EXCITED STATES BY LASER-INDUCED FLUORESCENCE Final Report, Oct. 1982 - Sep. 1986
A. B. Wedding and A. V. Phelps Apr. 1987 37 p
(Contract MIPR-FY1455-85-0601; AF Proj. 230-1)
(AD-A180348; AFWAL-TR-86-2113) Avail: NTIS HC A03/MF A01 CSCL 20E

Laser absorption techniques have been used to measure the collisional quenching rate coefficients for a number of levels of the hydrogen state. These rate coefficients are nearly independent of rotational and vibrational quantum number, i.e., 1.7 2.0 x ten to the negative fifteen cubic meters. Techniques are being developed for the measurement of electron excitation coefficients for the H2 state. Results are presented from attempts to model experimental measurements of 634 nm emission produced in collisions of pairs of oxygen metastables in the afterglow of pulsed discharges in oxygen-argon mixtures. GRA

N87-25569# West Virginia Univ., Morgantown. Dept. of Physics.
HIGH FLUX LASER RADIATION AND RESIDUAL GAS INTERACTIONS WITH CARBON-BASED STRUCTURAL MATERIALS Final Technical Report, 1 Feb. 1986 - 31 Jan. 1987
Bernard R. Cooper and Pedro A. Montano 6 Apr. 1987 23 p
(Grant AF-AFOSR-0072-86)
(AD-A180506; AFOSR-87-0674TR) Avail: NTIS HC A02/MF A01 CSCL 11D

The systems studied included NaCl-structure (naturally occurring) TiC, Ti/C superlattices and (111) single crystal faces of Ti reacted with CO. The interest in titanium carbide is based on its importance as a high temperature material, combining high melting point, hardness, heat resistance and light weight. Our research was aimed at seeing the feasibility for growing and characterizing artificial superlattices of titanium carbides and comparing their properties to that of naturally occurring titanium carbide which is a cubic metallic conductor. GRA

N87-25570*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RANGE AND RANGE RATE SYSTEM Patent Application
Olin Leonard Graham, inventor (to NASA), Jim Kevin Russell, inventor (to NASA), and Walter Lane Epperly, inventor (to NASA) (Westinghouse Electric Corp., Baltimore, Md.) 4 May 1987 19 p
(NASA-Case-MSC-20867-1; NAS 1.71:MSC-20867-1; US-Patent-Appl-SN-045984) Avail: NTIS HC A02/MF A01 CSCL 20E

A video controlled solid state range finding system which requires no radar, high power laser, or sophisticated laser target is disclosed. The effective range of the system is from 1 to about 200 feet. The system includes an opto-electric camera such as a lens/CCD array device. A helium neon laser produces a source beam of coherent light which is applied to a beam splitter. The beam splitter applies a reference beam to the camera and produces an outgoing beam applied to a first angularly variable reflector which directs the outgoing beam to the distant object. An incoming beam is reflected from the object to a second angularly variable reflector which reflects the incoming beam to the opto-electric camera via the beam splitter. The first reflector and the second reflector are configured so that the distance travelled by the outgoing beam from the beam splitter and the first reflector is the same as the distance travelled by the incoming beam from the second reflector to the beam splitter. The reference beam produces a reference signal in the geometric center of the camera. The incoming beam produces an object signal at the camera. The difference between the reference signal and the object signal is used, with manual or automatic means, to vary the angle alpha between the outgoing beam from the first reflector and the reference line between reflecting points of the first and second reflectors and the angle beta between the incoming beam from the second reflector and the reference line. The angles alpha and beta are maintained essentially equal. The difference between the reference signal and object signal is used to provide an output to a rotator driver circuit to vary the angles of the first and second reflectors until the reference signal and object signal are coincident. Range R is then determined as R = D tan alpha. NASA

N87-25381# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
COMPUTATION OF PRECISE STATION COORDINATES USING LASER RANGING
Hermann Hauck *In* ESA Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 223-226 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01 CSCL 06/64

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N87-25571# NUCLEP, Rio de Janeiro (Brazil).
SUBMERGED-ARC WELDING IN NARROW CHAMFER OF STEEL DIN 20MnMoNi55 WITH NUCLEAR QUALITY
M. M. Moraes and J. M. A. Rebello 1986 22 p In PORTUGESE; In PORTUGUESE Presented at the 12th National Technology Meeting of Welding Technology, Campos do Jordao, Brazil, 1 Oct. 1986 Prepared in cooperation with Rio de Janeiro Univ., Brazil
(DE87-701814; INIS-BR-601; CONF-8610259-1) Avail: NTIS (US Sales Only) HC A02/MF A01

A procedure for welding thick plates (140 mm) of steel DIN 20MnMoNi55 (ASTM A 533 grB cl1) of nuclear quality by submerged-arc process in narrow chamfer using wire S3NiMol of 0.5 mm diameter was developed. A head of specific welding was constructed, and samples were welded aiming to optimize the welding parameters and to investigate the influence of the length from wire to chamfer face in quality of joint. The joints were evaluated by mechanical and metallographic tests. The results were compared with a joint of the same thickness welded by submerged-arc process in conventional chamfer. DOE

N87-25572# Los Alamos National Lab., N. Mex.
THE ARGONNE BEAMLINE-B TELESCOPE CONTROL SYSTEM: A STUDY OF ADAPTABILITY
M. A. Fuka, P. N. Clout, A. P. Conley, J. O. Hill, R. B. Rothrock, L. L. Trease, and M. E. Zander 1987 4 p Presented at the Particle Accelerator Conference, Washington, D.C., 16 Mar. 1987
(Contract W-7405-eng-36)
(DE87-007675; LA-UR-87-501; CONF-870302-71) Avail: NTIS HC A02/MF A01

A beam-expanding telescope to study high-precision H(-) particle optics and beam sensing was designed by the Accelerator Technology Division at Los Alamos National Laboratory and will be installed on beamline-B at Argonne National Laboratory. The control system for this telescope was developed in a relatively short period of time using experience gained from building the Proton Storage Ring (PSR) control system. The designers modified hardware and software to take advantage of new technology as well as to meet the requirements of the new system. This paper discusses lessons learned in the process of adapting hardware and software from an existing control system to one with rather different requirements. DOE

N87-25573* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SELF-COMPENSATING SOLENOID VALVE Patent
Fritz H. Woeller, inventor (to NASA) and Yutaka Matsumoto, inventor (to NASA) 21 Jul. 1987 5 p Filed 7 Nov. 1985 Supersedes N86-21859 (24 - 12, p 1956)
(NASA-Case-ARC-11620-1; US-Patent-4,681,142; US-Patent-Appl-SN-795945; US-Patent-Class-137-614.18; US-Patent-Class-137-614.11; US-Patent-Class-251-129.15; US-Patent-Class-251-175) Avail: US Patent and Trademark Office CSCL 13K

A solenoid valve is described in which both an inlet and an outlet of the valve are sealed when the valve is closed. This double seal compensates for leakage at either the inlet or the outlet by making the other seal more effective in response to the leakage and allows the reversal of the flow direction by simply switching the inlet and outlet connections. The solenoid valve has a valve chamber within the valve body. Inlet and outlet tubes extend through a plate into the chamber. A movable core in the chamber extends into the solenoid coil. The distal end of the core has a silicone rubber plug. Other than when the solenoid is energized, the compressed spring biases the core downward so that the surface of the plug is in sealing engagement with the ends of the tubes. A leak at either end increases the pressure in the chamber, resulting in increased sealing force of the plug.
Official Gazette of the U.S. Patent and Trademark Office

N87-25574# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mechanical Engineering.
THE EFFECT OF FLUID INERTIA AND VISCOELASTICITY IN SQUEEZE-FILM DAMPER BEARINGS Final Report, 1 Apr. 1984 - 31 Mar. 1987
John A. Tichy 4 May 1987 21 p
(Contract DAAG29-84-K-0041)
(AD-A180491; ARO-20771.5-EG) Avail: NTIS HC A02/MF A01 CSCL 13I

The following papers best serve as a description of progress on this project: Study of the Effect of Fluid Inertia and End Leakage in the Finite Squeeze Film Damper; Application of the k-epsilon Turbulence Model to the Squeeze Film Damper; Lubricating Films of a Viscoelastic Fluid, including Fluid Inertia, Studied by a Linearization Method; The Effect of Fluid Inertia in Hydrodynamic Lubrication Studied by a Linearization Method: Two Useful Applications; Measurements of Squeeze film bearing forces and Pressures, including the Effect of Fluid Inertia; On Suitable Boundary Conditions for the Second-Order Fluid in the Cylinder Plane Contact; A Thin Flow Rupture Model for Newtonian and Viscoelastic Fluids. GRA

N87-25575*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A WELDING MONITORING SYSTEM Patent Application

S. G. Babcock, inventor (to NASA) (Rockwell International Corp., Huntsville, Ala.) 2 Feb. 1987 14 p

(NASA-Case-MFS-29177-1; US-Patent-Appl-SN-010942) Avail: NTIS HC A02/MF A01 CSCL 13H

This invention relates generally to systems for remotely monitoring automatic welding operations, and more particularly to a system wherein the welder is readily positionable, while components of the optical system remain fixed. A welder having an electrode is mounted in an enclosure containing a pair of mirrors. The electrode passes through an opening in the first mirror and a gas cup. The mirror reflects an image of a welding operation taken through the opening of the gas cup to the second mirror. The second mirror then reflects the image through a rotary coupling to a third mirror which, in turn, reflects the image to a receiving lens mounted to a second rotatable coupling. The image is then projected via a fiber optic bundle to a filter unit where selected wavelengths of light are filtered from the welding image. The filter unit is coupled to an enlarger which enlarges the image and passes it to a camera. The camera is connected to an electronic eclipser which selectively darkens the brightest portions of the image. Finally, the image is recorded by a video tape recorder and displayed by a monitor. M.G.

N87-25576*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

COLLECT LOCK JOINT FOR SPACE STATION TRUSS Patent Application

Clarence J. Wesselski, inventor (to NASA) 1 Apr. 1987 19 p

(NASA-Case-MSC-21207-1; US-Patent-Appl-SN-032818) Avail: NTIS HC A02/MF A01 CSCL 13K

A lock joint for a space station has a plurality of struts joined together in a predetermined configuration by node point fittings. The fittings have removable inserts therein. The lock joint has an elongated housing connected at one end to a strut. A split-fingered collet is mounted within the housing for movement reciprocally therein. A handle on the housing is connected to the collet for moving the collet into the insert where the fingers of the collet expand to lock the joint to the fitting. NASA

N87-25577*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

TECHNIQUE FOR MEASURING HOLE ELONGATION IN A BOLTED JOINT Patent Application

Gregory R. Wichorek, inventor (to NASA) 5 Feb. 1987 11 p

(NASA-Case-LAR-13453-1; NAS 1.71:LAR-13453-1; US-Patent-Appl-SN-010950) Avail: NTIS HC A02/MF A01 CSCL 13K

A device to determine the operable failure mode of mechanically fastened lightweight composite joints by measuring the hole elongation of a bolted joint is disclosed. The double-lap joint test apparatus comprises a stud, a test specimen having a hole, two load transfer plates, and linear displacement measuring instruments. The test specimen is sandwiched between the two load transfer plates and clamped together with the stud. Spacer washers are placed between the test specimen and each load transfer plate to provide a known, controllable area for the determination of clamping forces around the hole of the specimen attributable to bolt torque. The spacer washers also provide a gap for the mounting of reference angles on each side of the test specimen. Under tensile loading, elongation of the hole of the test specimen causes the stud to move away from the reference angles. This displacement is measured by the voltage output of two linear displacement measuring instruments that are attached to the stud and remain in contact with the reference angles throughout the tensile loading. The present invention obviates previous problems in obtaining specimen deformation measurements by mounting the reference angles to the test specimen and the linear displacement measuring instruments to the stud. NASA

N87-25578*# Sikorsky Aircraft, Stratford, Conn.

AUTOMATED INSPECTION AND PRECISION GRINDING OF SPIRAL BEVEL GEARS Final Report

Harold Frint Washington NASA Jul. 1987 83 p

(Contract NAS3-25465; DA Proj. 1L1-62209-AH-76) (NASA-CR-4083; E-3604; SER-510220; NAS 1.26:4083; AVSCOM-TR-87-C-11) Avail: NTIS HC A05/MF A01 CSCL 13I

The results are presented of a four phase MM&T program to define, develop, and evaluate an improved inspection system for spiral bevel gears. The improved method utilizes a multi-axis coordinate measuring machine which maps the working flank of the tooth and compares it to nominal reference values stored in the machine's computer. A unique feature of the system is that corrective grinding machine settings can be automatically calculated and printed out when necessary to correct an errant tooth profile. This new method eliminates most of the subjective decision making involved in the present method, which compares contact patterns obtained when the gear set is run under light load in a rolling test machine. It produces a higher quality gear with significant inspection time and cost savings. Author

N87-25579*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

ANALYSIS OF THE VIBRATORY EXCITATION ARISING FROM SPIRAL BEVEL GEARS Final Report

William D. Mark Washington NASA Jul. 1987 122 p

(Contract NAS3-23703)

(NASA-CR-4081; E-3580; Rept-6451; NAS 1.26:4081) Avail: NTIS HC A06/MF A01 CSCL 13I

Tools required to understand and predict in terms of its underlying causes the vibratory excitation arising from meshing spiral bevel gears are developed. A generalized three component transmission error of meshing spiral bevel gears is defined. Equations are derived that yield the three components of the generalized transmission error in terms of deviations of tooth running surfaces from equispaced perfect spherical involute surfaces and tooth/gearbody elastic deformations arising from the three components of the generalized force transmitted by the meshing gears. A method for incorporating these equations into the equations of motion of a gear system is described. Equations are derived for the three components of the generalized force transmitted by the gears which are valid whenever inertial effects of the meshing gears and their supports are negligible. Bearing offsets from the positions occupied by the shaft centerlines of perfect spherical involute bevel gears and bearing/bearing support flexibilities enter into the computation of these forces. Author

N87-25580 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Verkehrstechnik.

NEW TECHNOLOGIES FOR BOGIES

Christian Guenther, Rolf Leo, and Werner Geuenich 1985 12 p Repr. from ZEV-Glasers Annalen, v. 109, no. 2/3, Feb. - Mar. 1985 p 3-11 In GERMAN; ENGLISH summary Presented at the 22nd Tagung Moderne Schienehmensbereich Verkehrstechnik, Graz, Australia, 7-10 Oct. 1984

(MBB-Z-79/85; ETN-87-99973) Copyright Avail: Issuing Activity

The application of fiber composite technology, developed by the aerospace industry, to rolling stock, and the integration of the support and guidance system creep-controlled wheelset into a high speed bogie are discussed. The characteristics of fiber composite materials, and their design possibilities are presented. The function and purpose of the creep-controlled wheelset, and results of running tests conducted on a roller test rig are outlined. The concept of a high speed bogie featuring a fiber composite frame, and the way to develop and construct such a bogie are presented. Design calculations, and simulation results for a bogie with a fiber composite frame and creep-controlled wheelsets, are given. Results are discussed, especially those concerning the roller rig tests on the prototypes of creep-controlled wheelsets, and those related to static dynamic tests on the longitudinal fiber composite frame for the new high speed bogie. ESA

N87-25581 ESDU International Ltd., London (England).
FATIGUE STRENGTH OF EXTERNAL AND INTERNAL STEEL SCREW THREADS UNDER AXIAL LOADING. (STANDARD FORMS NOT GREATER THAN 1.0 INCH DIAMETER).
Dec. 1984 10 p Supersedes ESDU-69001
(ESDU-84037; ISBN-0-85679-501-1; ISSN-0141-4089; ISSN-0141-3996) Avail: ESDU

This Data Item 84037, an addition to the Stress and Strength and Fatigue-Endurance Data Sub-series, provides the evaluated analysis of some 1500 fatigue tests, drawn from the literature, on externally threaded members loaded through the nut. The results are shown in two graphs of stress against endurance, one for cut threads and one for form-rolled threads. They show that, for five standard thread forms (UNF coarse and fine, BSF, BSW, and ISO metric coarse) and over a range of diameters, 0,25 in (6.33 mm) to 1.0 in (25 mm), the method of manufacture dominates fatigue strength. Variations resulting from five methods of thread manufacture showed fatigue limits that varied by a factor of up to three. Variations resulting from thread form or size within any one method manufacture were too small in relation to the scatter of results to be distinguished. For internally threaded components, an evaluated analysis of some 50 tests, drawn from the literature, is given. Such components rarely fail in fatigue, but the results show that, if a thin nut is required, the risk of fatigue is reduced by maximising material ductility. ESDU

N87-25582* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PRELOADABLE VECTOR SENSITIVE LATCH Patent
William R. Acres, inventor (to NASA) 28 Jul. 1987 13 p Filed 3 Oct. 1985 Supersedes N86-19613 (24 - 10, p 1584)
(NASA-Case-MSC-20910-1; US-Patent-4,682,745; US-Patent-Appl-SN-783888; US-Patent-Class-244-161; US-Patent-Class-292-DIG.49; US-Patent-Class-292-201; US-Patent-Class-292-64) Avail: Issuing Activity CSCL 13K

A preloadable vector-sensitive latch which automatically releases when the force vector from a latch memebr reaches a specified release angle is presented. In addition, it contains means to remove clearance between the latched members and to preload the latch to prevent separation at angles less than the specified release angle. The latch comprises a triangular main link, a free link connected between a first corner of the main link and a yoke member, a housing, and an actuator connected between the yoke member and the housing. A return spring bias means connects the main link to a portion of the housing. A second corner of the main link is slidably and pivotally connected to the housing via a slot in a web portion of the housing. The latch housing has a rigid docking ring alignable with a mating locking ring which is engageable by a locking roller journalled on the third corner of the triangular main link.
Official Gazette of the U.S. Patent and Trademark Office

N87-25583*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
QUICK-DISCONNECT INFLATABLE SEAL ASSEMBLY Patent Application
Kurt D. Buehler, inventor (to NASA) and James E. Fesmire, inventor (to NASA) 22 May 1987 20 p
(NASA-Case-KSC-11368-1; US-Patent-Appl-SN-052940) Avail: NTIS HC A02/MF A01 CSCL 11A

The present invention concerns an inflatable seal assembly adapted for use with a bayonet quick-disconnect system particularly useful for the insulated transfer of cryogenic consumables in orbit (such as between a space station and a re-supply vehicle). The zero-leak cryogenic coupling includes a polymeric seal clamped to a male bayonet member with two pairs of tightening rings. The tightening rings threadably engage each other in respective pairs around tapered ends of the inflatable seal member so that a wedging action tightens the seal member about the male bayonet. Once in place, the seal may be inflated via an inflation port so that its expansion provides pressure contact with the inside surface of a coaxial female member. NASA

N87-25584*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AUXILIARY DATA INPUT DEVICE Patent Application
H. Douglas Garner, inventor (to NASA), Anthony M. Busquets, inventor (to NASA), Thomas W. Hogge, inventor (to NASA), and Russell V. Parrish, inventor (to NASA) 18 Jun. 1987 15 p
(NASA-Case-LAR-13626-1; US-Patent-Appl-SN-063557) Avail: NTIS HC A02/MF A01 CSCL 13I

An object of this invention is to provide in a control lever, a continuous, bi-coordinate, data entry device that can be manipulated by an operator's hand without the necessity of removing the hand from the control lever. The improved data entry device is provided with a handle element having a finger portion. A ball element is rotatably disposed in the finger portion and remains subject to manipulation by a single finger of the human hand grasping the handle element. The combination of drive shafts, roller elements, disk elements, light sources, and photodetection elements provide continuous output signals that describe the magnitide and direction of the ball element in two dimensions. The output signals can then be utilized, for example, to change the heading of an aircraft. NASA

N87-25585*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CARBIDE-FLUORIDE-SILVER SELF-LUBRICATING COMPOSITE Patent Application
Harold E. Sliney, inventor (to NASA) 28 May 1987 13 p
(NASA-Case-LEW-14196-2; US-Patent-Appl-SN-054983) Avail: NTIS HC A02/MF A01 CSCL 11H

A self-lubricating, friction and wear reducing composite material is described for use over a wide temperature spectrum from cryogenic temperature to about 900 C in a chemically reactive environment comprising silver, barium fluoride/calcium fluoride eutectic, and metal bonded chromium carbide. NASA

N87-25586*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BI-STEM GRIPPING APPARATUS Patent Application
Fred G. Sanders, inventor (to NASA) 3 Jun. 1987 13 p
(NASA-Case-MFS-28185-1; US-Patent-Appl-SN-056930) Avail: NTIS HC A02/MF A01 CSCL 13I

This invention relates to devices which grip cylindrical structures and more particularly to a device which has three arcuate gripping members having frictional surfaces for gripping and compressing a bi-stem. The bi-stem gripping apparatus is constructed having a pair of side gripping members, and an intermediate gripping member disposed between them. Sheets of a gum stock silicone rubber with frictional gripping surfaces are bonded to the inner region of the gripping members and provide frictional engagement between the bi-stem and the apparatus. A latch secures the gripping apparatus to a bi-stem, and removable handles are attached, allowing an astronaut to pull the bi-stem from its cassette. A tethering ring on the outside of the gripping apparatus provides a convenient point to which a lanyard may be attached. NASA

N87-25587*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WELDING TORCH GAS CUP EXTENSION
Stephen S. Gordon, inventor (to NASA) (Rockwell International Corp., Huntsville, Ala.) 30 Apr. 1987 8 p
(Contract NAS8-27980)
(NASA-Case-MFS-29252-1; US-Patent-Appl-SN-044181) Avail: NTIS HC A02/MF A01 CSCL 13H

The invention relates to a gas shielded electric arc welding torch having a detachable gas cup extension which may be of any desired configuration or length. The gas cup extension assembly is mounted on a standard electric welding torch gas cup to enable welding in areas with limited access. The gas cup assembly has an upper tubular insert that fits within the gas cup such that its lower portion protrudes therefrom and has a lower tubular extension that is screwed into the lower portion. The extension has a rim to define the outer perimeter of the seat edge about its entrance opening so a gasket may be placed to

effect an airtight seal between the gas cup and extension. The tubular extension may be made of metal or ceramic material that can be machined. The novelty lies in the use of an extension assembly for a standard gas cup of an electric arc welding torch which extension assembly is detachable permitting the use of a number of extensions which may be of different configurations and materials and yet fit the standard gas cup. NASA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N87-25588# Commissariat aux Energies Nouvelles, Algiers (Algeria). Centre d'Etudes Nucleaires et Solaires.
STUDY OF THE SIMULATION OF WORKING OF ULTRASONIC EQUIPMENT IN ORDER TO OPTIMIZE THE NONDESTRUCTIVE CONTROL CONDITIONS M.S. Thesis
R. Drai Jan. 1986 140 p In FRENCH
(DE87-701820; INIS-mf-10539) Avail: NTIS (US Sales Only) HC A07/MF A01

The aim of this study is, for the long run, to define one or several procedures of ultrasonic nondestructive testing, allowing the use of the equipment, at their best conditions. In this work, the behavior of the testing system is simulated. The water bounded by a reflector plane is taken as a propagation medium. The testing equipment is considered as a system composed by a set of subsystems (generator, cable, transducers and reception amplifiers). Each of these subsystems is modeled by its respective transfer functions. Thus, an experimental procedure for measuring subsystem characteristics is given in order to calculate the different transfer functions. With this model, we have the possibility to obtain, by calculation, all signals given by the testing system for any combination of these parameters: damping, attenuation, cable length... So, it is possible to establish prior to the test, the adequate conditions for the testing system (high sensitivity, good resolution, or good compromise between both). DOE

N87-25589*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RAY PROPAGATION PATH ANALYSIS OF ACOUSTO-ULTRASONIC SIGNALS IN COMPOSITES
Harold E. Kautz 1987 20 p Presented at Acousto-Ultrasonics: Theory and Application, Blacksburg, Va., 12-15 Jul. 1987; sponsored by NASA
(NASA-TM-100148; E-3706; NAS 1.15:100148) Avail: NTIS HC A02/MF A01 CSCL 14D

The most important result was the demonstration that acousto-ultrasonic (AU) energy introduced into a laminated graphite/resin propagates by two modes through the structure. The first mode, along the graphite fibers, is the faster. The second mode, through the resin matrix, besides being slower is also more strongly attenuated at the higher frequencies. This demonstration was accomplished by analyzing the time and frequency domain of the composite AU signal and comparing them to the same for a neat resin specimen of the same chemistry and geometry as the composite matrix. Analysis of the fine structure of AU spectra was accomplished by various geometrical strategies. It was shown that the multitude of narrow peaks associated with AU spectra are the effect of the many pulse arrivals in the signal. The shape and distribution of the peaks is mainly determined by the condition of nonnormal reflections of ray paths. A cepstrum analysis was employed which can be useful in detecting characteristic times. Analysis of propagation modes can be accomplished while ignoring the fine structure. Author

N87-25498# Joint Publications Research Service, Arlington, Va.
DEVELOPMENTS IN MACHINE RELIABILITY, SERVICE LIFE REVIEWED
K. V. Frolov *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 29-42 Transl. into ENGLISH from Vestnik Akademii Nauk SSSR (Moscow, USSR), no. 8, Aug. 1985 p 74-84 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N87-25590 GKSS-Forschungszentrum Geesthacht (West Germany).
ON THE EXPERIMENTAL DETERMINATION OF CRACK TIP OPENING DISPLACEMENT (CTOD) BASED R-CURVES
D. Hellmann and K.-H. Schwalbe, ed. 1986 20 p Presented at the Crack Tip Opening Displacement in Elastic-Plastic Fracture Mechanics Workshop on CTOD Methodology, Geesthacht, West Germany, 23-25 Apr. 1985
(GKSS-85/E/59; ISSN-0344-9629; ETN-87-99659) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

It is demonstrated that the British Standard BS 5762 for measuring the crack tip opening displacement (CTOD) can be modified such that the resulting CTOD is equal to the CTOD measured at the fatigue crack tip. The modifications consist of accounting for crack growth and adjustment of the rotation factor to the material under consideration. The results obtained on six different materials show that the rotation factor depends slightly on the material and is independent of specimen type, crack length, specimen thickness, and amount of crack growth. ESA

N87-25591 GKSS-Forschungszentrum Geesthacht (West Germany).
RELATIONSHIPS BETWEEN VARIOUS DEFINITIONS OF THE CRACK TIP OPENING DISPLACEMENT
K. H. Schwalbe, ed., J. Heerens, D. Hellmann, and A. Cornec 1986 23 p Presented at the Crack Tip Opening Displacement in Elastic-Plastic Fracture Mechanics Workshop on CTOD Methodology, Gessthacht, West Germany, 23-25 Apr. 1985
(GKSS-85/E/60; ISSN-0344-9629; ETN-87-99660) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

It is argued that the crack tip opening displacement problem is very much a matter of definition. Comparison of definitions used for analytical treatment or for experimental determinations shows that by the widely used experimental methods a quantity is determined which is at variance with the commonly accepted definition as the opening of 2 points on the crack faces located on 2 straight lines emanating from the crack tip including an angle or + or - 45 deg with the undeformed crack. ESA

N87-25592 GKSS-Forschungszentrum Geesthacht (West Germany).
THE PREDICTION OF FAILURE SITUATIONS USING THE CRACK TIP OPENING DISPLACEMENT (CTOD) CONCEPT BASED ON THE ENGINEERING TREATMENT MODEL (ETM)
K.-H. Schwalbe, ed. 1986 28 p Presented at the Crack Tip Opening Displacement in Elastic-Plastic Fracture Mechanics Workshop on CTOD Methodology, Geesthacht, West Germany, 23-25 Apr. 1985
(GKSS-85/E/61; ISSN-0344-9629; ETN-87-99661) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

Under the assumption of plane stress conditions, the crack tip opening displacement concept is extended such that a full R-curve methodology arises, consisting of an experimental procedure for the determination of the R-curve and of the driving force prediction. Predictions of initiation and maximum loads are in reasonable agreement with experimental results. ESA

N87-25593 GKSS-Forschungszentrum Geesthacht (West Germany).
FRACTURE MECHANICS TESTS ON AXIALLY CRACKED PIPE SECTIONS SUBJECTED TO INTERNAL PRESSURE
K. E. Aeberli, D. Schulze, P. Morawietz, H. Fuhlrott, J. Heerens, and K.-H. Schwalbe, ed. 1986 22 p Presented at the Crack Tip Opening Displacement in Elastic-Plastic Fracture Mechanics Workshop on CTOD Methodology, Geesthacht, West Germany, 23-25 Apr. 1985
(GKSS-85/E/62; ISSN-0344-9629; ETN-87-99670) Copyright
Avail: Fachinformationszentrum, Karlsruhe, West Germany

In order to investigate the validity of the crack tip opening displacement, delta 5, as a crack field parameter, axially cracked pipe sections were internally pressured and delta 5-R-curves were recorded. A comparison of these with delta 5-R-curves of similar compact tension specimens shows close coincidence largely independent of initial crack length and of plastic bulging in the cracked region of the pipe sections. ESA

N87-25594 Harvard Univ., Cambridge, Mass.
HIGH STRAIN-RATE CRACK GROWTH Ph.D. Thesis
Peter Andrew Mataga 1986 122 p
Avail: Univ. Microfilms Order No. DA8704427

The mechanics of crack tip plasticity in dynamic crack growth is considered. The viewpoint is taken that the crack is travelling through material with a relatively high density of pre-existing mobile dislocations. In order to assess the role played by the associated rate-dependent plasticity a dissipative zone near the tip is modeled employing continuum small-strain plasticity theory. A finite element analysis is performed of steady growth of a sharp crack in a material which exhibits a linear increase of flow stress with plastic strain rate at strain rates higher than some transition level. This transition strain rate is typically of the order 10 to the 3d x 10 to the 4th/s in structural metals. Results for the ratio of crack tip energy release rate are generated. The numerical results are compared to an approximate analysis performed by Freund and Hutchinson, and a modification is proposed. These results are employed to predict dynamic cleavage fracture phenomena such as crack arrest, suppression of cleavage and the ductile-brittle transition. In addition, the effect of strain-rate material behavior on crack growth by a ductile micro-void growth mechanism is modeled, with suggestive though somewhat qualitative results. Dissert. Abstr.

N87-25595# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
DEVELOPMENT OF FATIGUE CRACK CLOSURE WITH THE EXTENSION OF LONG AND SHORT CRACKS IN ALUMINUM ALLOY 2124: A COMPARISON OF EXPERIMENTAL AND NUMERICAL RESULTS
Robert 0. Ritchie, Weikang Yu, Dan K. Holm, and Anders F. Blom Oct. 1986 40 p Sponsored by the Swedish Board for Technical Development
(Grant AF-AFOSR-000181-82)
(FFA-TN-1986-58; ETN-87-99781) Avail: NTIS HC A03/MF A01

Growth rate and closure behavior of long (17 to 38 mm) cracks in compact C(T) specimens and through-thickness physically-short (50 to 400 micron) cracks in SEN(B) bend specimens were examined experimentally from threshold levels to instability and results compared with those predicted numerically using an elastic-plastic finite element analysis of fatigue crack advance in plane strain. It is shown that the numerical analysis consistently underpredicts the magnitude of crack closure for long and short cracks, particularly at near-threshold levels. This is attributed to the fact that the numerical procedures can only model contributions to closure from cyclic plasticity, whereas, in reality, significant additional closure arises from the wedging action of fracture surface asperities and corrosion debris. Such closure is shown to provide the predominant mechanism for rationalizing differences in the growth rate behavior between long and physically-short cracks, although other factors such as the nature of the singularity and the extent of local plasticity are deemed to be potentially important. ESA

N87-25596# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Werkstofftechnologie.
EFFECT OF NOTCHES ON FATIGUE CRACK GROWTH
D. Rhodes 1986 33 p
(GKSS-86/E/50; ISSN-0344-9629; ETN-87-99916) Copyright
Avail: NTIS HC A03/MF A01

Fatigue crack growth in specimens of commercial engineering alloys (aluminum, structural steel), containing blunt, machined notches is summarized. The fatigue life depends on the time taken to propagate a crack from a surface defect, and the propagation rate depends on the plastic deformation range at the crack tip, which is characterized by the stress intensity range, once the crack extends beyond the notch strain field. Areas in which this work may be extended, and refined, are discussed. Crack closure and environmental effects are considered, and the effect of cyclic softening is discussed. ESA

N87-25597# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
INTEGRATION OF STATISTICAL AND PHYSICAL MODELS OF SHORT FATIGUE CRACK GROWTH Annual Report, 15 Jan. 1986 - 14 Jan. 1987
B. N. Cox and W. L. Morris Feb. 1987 50 p
(Contract F49620-85-C-0034)
(AD-A179725; SC5418-AR; AFOSR-87-0397TR; AR-2) Avail: NTIS HC A03/MF A01 CSCL 20K

A computer program has been written that generates Monte Carlo simulations of small fatigue crack growth. The simulations allow predictions of the statistics of growth given postulated or empirical laws defining the effects of local stochastic microstructure. Variations in crack shape and irregularity of the crack front, correlations between surface and subsurface growth rates, and the probability and effects of part or all of the crack front being temporarily arrested at grain boundaries can all be calculated. The simulation of embedded and surface cracks of irregular shape is made feasible by the development of approximate, fast algorithms for estimating variations in the Mode I stress intensity factor, k sub i around an irregular plane crack. The simulations provide a convenient way of generating large, detailed, synthetic data bases for small crack growth under diverse conditions. These data bases can then be used in lieu of experimental data to test simpler, but more efficient and robust probabilistic models of crack growth such as the one developed in the first year of this program. They also provide the theoretical framework required for understanding the role of fluctuations in the shape of small cracks in determining their rate of growth. By comparing the predicted statistics of the shape of small cracks with experimental data such as from striations, postulated laws of the dependence of growth rate on stochastic microstructure can be tested. GRA

N87-25598# Los Alamos National Lab., N. Mex.
GROWTH OF BUCKLING INSTABILITIES DURING RADIAL COLLAPSE OF AN IMPULSIVELY-LOADED CYLINDRICAL SHELL
T. A. Duffey, R. H. Warnes, and J. M. Greene 1987 28 p Presented at the 5th National Congress on Pressure Vessels and Piping, San Diego, Calif., 28 Jun. 1987
(Contract W-7405-eng-36)
(DE87-002907; LA-UR-86-3852; CONF-870636-1) Avail: NTIS HC A03/MF A01

Conditions leading to the growth of initial imperfections for rings or cylindrical shells subjected to initial uniform inward impulsive velocity loading are investigated. The work is motivated by a need to prevent buckling of rings during the contracting ring test, which is used to determine intermediate strain rate compressive stress-strain data. A previous analysis by Abrahamson is extended to include deceleration of the ring during inward motion; and the results of this deceleration are found to greatly influence the growth of imperfections (buckling). Qualitative comparisons with experimental data are presented. DOE

N87-25599# Sandia National Labs., Albuquerque, N. Mex.
OPTICAL SENSING OF CHEMICALLY INDUCED STRAINS
M. A. Butler and D. S. Ginley 1987 12 p Presented at the 151st Electrochemical Society Meeting, Philadelphia, Pa., 10 May 1987
(Contract DE-AC04-76DP-00789)
(DE87-009714; SAND-87-1094C; CONF-870560-1) Avail: NTIS HC A02/MF A01

Coated optical fibers in an optical interferometer configuration have been used to measure in situ and in real time the strains induced by chemical changes in the coatings. With a palladium coating this technique has been used to measure hydrogen gas concentrations between 10 ppB and 2%. Using a metal coated fiber in an electrochemical cell, the strains induced during electrodeposition of palladium and nickel have been measured. Strains associated with the anodic oxidation of titanium have also been measured. The implications of this new technique for other chemical and electrochemical environments are discussed. DOE

N87-25600# Oak Ridge National Lab., Tenn.
IMPLEMENTING FRACTURE MECHANICS ANALYSIS ON A DISTRIBUTED-MEMORY PARALLEL PROCESSOR
J. A. Clinard and G. A. Geist Mar. 1987 19 p
(Contract DE-AC05-84OR-21400)
(DE87-009778; ORNL/TM-10367) Avail: NTIS HC A02/MF A01

As part of an exploratory studies initiative at Oak Ridge National Laboratory, a parallel algorithm was developed and implemented for finite-element fracture mechanics. It was actually implemented on an Intel iPSC hypercube, although the algorithm was designed for any distributed-memory parallel computer with message passing primitives. A p-frontal method was developed for the solution of the equilibrium equations. This method required only log p communication exchanges between processors during the solution. On four processors, the parallel code solved a sample problem 2.7 times faster than the serial code, ORVIRT.PC, from which it was derived. DOE

N87-25601* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FATIGUE TESTING A PLURALITY OF TEST SPECIMENS AND METHOD Patent
James D. Hodo, inventor (to NASA), Dennis R. Moore, inventor (to NASA), Thomas F. Morris, inventor (to NASA), and Newton G. Tiller, inventor (to NASA) 30 Jun. 1987 7 p Filed 16 Jul. 1986 Supersedes N86-32770 (24 - 24, p 3740)
(NASA-Case-MFS-28118-1; US-Patent-4,676,110; US-Patent-Appl-SN-886121; US-Patent-Class-73-809; US-Patent-Class-73-810) Avail: US Patent and Trademark Office CSCL 20K

Described is a fatigue testing apparatus for simultaneously subjecting a plurality of material test specimens to cyclical tension loading to determine the fatigue strength of the material. The fatigue testing apparatus includes a pulling head having cylinders defined therein which carry reciprocating pistons. The reciprocation of the pistons is determined by cyclical supplies of pressurized fluid to the cylinders. Piston rods extend from the pistons through the pulling head and are attachable to one end of the test specimens, the other end of the test specimens being attachable to a fixed base, causing test specimens attached between the piston rods and the base to be subjected to cyclical tension loading. Because all the cylinders share a common pressurized fluid supply, the breaking of a test specimen does not substantially affect the pressure of the fluid supplied to the other cylinders nor the tension applied to the other test specimens.
Official Gazette of the U.S. Patent and Trademark Office

N87-25602*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FINITE-ELEMENT ANALYSIS OF CORNER CRACKS IN RECTANGULAR BARS
L. S. Raju (Analytical Services and Materials, Inc., Hampton, Va.) and J. C. Newman, Jr. Jun. 1987 47 p
(NASA-TM-89070; NAS 1.15:89070) Avail: NTIS HC A03/MF A01 CSCL 20K

Stress intensity factors for a wide range of quarter-elliptical corner cracks in rectangular bars are presented. Cracked configurations were subjected to remote tension, in-plane bending, or out-of-plane bending. Results were compared with other numerical results for a quarter-circular corner crack configuration. The present results along the interior of the crack generally agreed within 3 percent with those from the literature. Some larger differences (3 to 13 percent) were observed near the intersection of the crack front and the free surfaces in the boundary layer region. Analyses were performed to study the effect of mesh refinement in the boundary layer region and the influence of Poisson's ratio on the distribution of stress-intensity factors.
Author

N87-25603*# Michigan Univ., Ann Arbor.
HEAT GENERATION IN AIRCRAFT TIRES UNDER YAWED ROLLING CONDITIONS
Richard N. Dodge and Samuel K. Clark Washington NASA Jul. 1987 58 p
(Grant NsG-1607)
(NASA-CR-4080; NAS 1.26:4080) Avail: NTIS HC A04/MF A01 CSCL 20K

An analytical model was developed for approximating the internal temperature distribution in an aircraft tire operating under conditions of yawed rolling. The model employs an assembly of elements to represent the tire cross section and treats the heat generated within the tire as a function of the change in strain energy associated with predicted tire flexure. Special contact scrubbing terms are superimposed on the symmetrical free rolling model to account for the slip during yawed rolling. An extensive experimental program was conducted to verify temperatures predicted from the analytical model. Data from this program were compared with calculation over a range of operating conditions, namely, vertical deflection, inflation pressure, yaw angle, and direction of yaw. Generally the analytical model predicted overall trends well and correlated reasonably well with individual measurements at locations throughout the cross section. Author

N87-25604# Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen (West Germany).
ANALYTICAL DESCRIPTION OF CRACK RESISTANCE CURVES FOR ALUMINUM SHEETS USED IN AIRCRAFT CONSTRUCTION
Vui Nguyen-Hoang 1986 4 p Repr. from Aluminum, v. 62, no. 8, 1986 p 593-595 In GERMAN; ENGLISH summary
(MBB-UT-133/85; ETN-87-99964) Avail: Issuing Activity

The R-curve concept was applied to predict the load-bearing capacity and the critical damage parameters for aluminum sheet aircraft components. The R-curves for the alloys 2024-T3, 7075-T6, and 7475-T761 are given, and the materials constants for the R-curves were determined. It was assumed that the contants C1 to C4 are valid for various sheet widths, sheet thicknesses, and crack lengths. This assumption was justified by the agreement found between predicted and experimental values of these constants. It is therefore justified to recommend the R-curve concept in the presented form for the prediction of residual strength and critical crack length. ESA

N87-25605*# Catholic Univ. of America, Washington, D.C. Dept. of Mechanical Engineering.
A COMPARISON BETWEEN IMSC, PI AND MIMSC METHODS IN CONTROLLING THE VIBRATION OF FLEXIBLE SYSTEMS
A. Baz and S. Poh Aug. 1987 31 p
(Grants NAG5-520; NAG5-749)
(NASA-CR-181156; NAS 1.26:181156) Avail: NTIS HC A03/MF A01 CSCL 20K

A comparative study is presented between three active control algorithms which have proven to be successful in controlling the vibrations of large flexible systems. These algorithms are: the Independent Modal Space Control (IMSC), the Pseudo-inverse (PI), and the Modified Independent Modal Space Control (MIMSC).

Emphasis is placed on demonstrating the effectiveness of the MIMSC method in controlling the vibration of large systems with small number of actuators by using an efficient time sharing strategy. Such a strategy favors the MIMSC over the IMSC method, which requires a large number of actuators to control equal number of modes, and also over the PI method which attempts to control large number of modes with smaller number of actuators through the use of an in-exact statistical realization of a modal controller. Numerical examples are presented to illustrate the main features of the three algorithms and the merits of the MIMSC method.
Author

N87-25606*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PRELIMINARY DESIGN, ANALYSIS, AND COSTING OF A DYNAMIC SCALE MODEL OF THE NASA SPACE STATION Final Report
M. J. Gronet, E. D. Pinson, H. L. Voqui, E. F. Crawley, and M. R. Everman (AEC-ABLE Engineering Co., Inc., Goleta, Calif.) Washington NASA Jul. 1987 208 p
(Contract NAS1-18229)
(NASA-CR-4068; NAS 1.26:4068; LMSC-F177633) Avail: NTIS HC A10/MF A01 CSCL 20K

The difficulty of testing the next generation of large flexible space structures on the ground places an emphasis on other means for validating predicted on-orbit dynamic behavior. Scale model technology represents one way of verifying analytical predictions with ground test data. This study investigates the preliminary design, scaling and cost trades for a Space Station dynamic scale model. The scaling of nonlinear joint behavior is studied from theoretical and practical points of view. Suspension system interaction trades are conducted for the ISS Dual Keel Configuration and Build-Up Stages suspended in the proposed NASA/LaRC Large Spacecraft Laboratory. Key issues addressed are scaling laws, replication vs. simulation of components, manufacturing, suspension interactions, joint behavior, damping, articulation capability, and cost. These issues are the subject of parametric trades versus the scale model factor. The results of these detailed analyses are used to recommend scale factors for four different scale model options, each with varying degrees of replication. Potential problems in constructing and testing the scale model are identified, and recommendations for further study are outlined.
Author

N87-25607*# Tulane Univ., New Orleans, La. Dept. of Mechanical Engineering.
MACROCRACK INTERACTION WITH TRANSVERSE ARRAY OF MICROCRACKS Final Contractor Report
A. A. Rubinstein and H. C. Choi (Illinois Univ., Urbana-Champaign.) Jul. 1987 25 p
(Grant NAG3-751)
(NASA-CR-180806; NAS 1.26:180806) Avail: NTIS HC A02/MF A01 CSCL 20K

General formulation of a problem involving a macrocrack propagating through an area with microcracks is considered. The analysis is based on the simultaneous solution of a system of singular integral equations. Various methods described in the literature are discussed in detail and compared. The specific problem considered was a macrocrack approaching an infinite transverse array of microcracks. Results illustrate the effects of different loading types and can be used for interpretation of the microcrack toughening mechanisms. Numerical comparisons are made with data recently appearing in literature which demonstrates the importance of numerical accuracy. Reported results differ by a factor in certain cases as compared with data given in other literature.
Author

N87-25608*# National Aeronautics and Space Administration, Washington, D.C.
POSTBUCKLING BEHAVIOR OF FIBER REINFORCED PLATES AND CURVED PANELS
Klaus Rohwer Jul. 1987 26 p Transl. into ENGLISH from "Nachbeulverhalter von Platten und Schalenfeldern aus Faserverbundstoff" Zeitschrift fur Flugwissenschaften und Weltraumforschung (West Germany), v. 10, Jul.-Aug. 1986 p 228-235 Original language document was announced in IAA as A87-18815 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document was prepared by DFVLR, Brunswick (West Germany)
(Contract NASw-4005)
(NASA-TT-20094; NAS 1.77:20094) Avail: NTIS HC A03/MF A01 CSCL 20K

Results obtained on the postbuckling behavior of plates and curved panels using the NOLIN computer program are reported. As an example, the postbuckling behavior of a flexible, isotropic and quadrangular plate is solved and the results are found to be accurate and relibale in comparison with those in the literature. The fatigue-deformation behavior of a rectangular CKL plate is measured, and the results are compared with those from NOLIN and other computer programs. A slightly curved panel with optimized layering is studied.
Author

N87-25609*# National Aeronautics and Space Administration, Washington, D.C.
ANALYSIS OF THE FREE VIBRATION OF THE ROTATING DISK
R. Hashimoto, A. Nagamatsu, and S. Michimura Jul. 1987 29 p Transl. into ENGLISH of Japanese report (NAL, Tokyo, Japan), Nov. 1987 p 1-11 Original language document was announced as N79-76956 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TT-20026; NAS 1.77:20026; NAL-TR-546) Avail: NTIS HC A03/MF A01 CSCL 20K

The vibration of the rotating disk is analyzed using the finite element method with consideration given to the effect of centrifugal force. A fan-shaped element is proposed for the first time for the analysis of both in-plane and bending deformations of the shell structure. The calculated results of the natural modes and frequencies of a model disk are compared with the experimental results with good quantitative agreement. .
Author

N87-25499# Joint Publications Research Service, Arlington, Va.
COMPARATIVE INVESTIGATIONS OF VIBROACOUSTICS OF METAL, POLYMER, AND METAL-POLYMERS GEARINGS
I. V. Zhuk and S. A. Osipenko *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 43-47 Transl. into ENGLISH from Vesti Akademii Navuk BSSR: Seriya Fizika-Tekhnichnykh Navuk (Minsk, USSR), no. 2, Jan. - Mar. 1986 p 59-62 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

N87-25504# Joint Publications Research Service, Arlington, Va.
SIMULATION OF RESONANT VIBRATIONS OF VIBRATION INSULATION SYSTEM UNDER EFFECT ON LOW-FREQUENCY PARAMETRIC EXCITATION
S. V. Vlasov, M. D. Genkin, E. G. Gudushauri, and V. G. Yelezov *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 78-84 Transl. into ENGLISH from Mashinovedeniye (Moscow, USSR), no. 3, May - Jun. 1986 p 89-92 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N87-25610# Texas Univ., Austin. Applied Research Lab.
DESIGN STUDY OF REMOTE SENSING FOR OCEAN SURFACE AND INTERIOR ACTIVITY Final Report, 1 Jul. 1985 - 30 Sep. 1986
Nicholas P. Chotiros 31 Dec. 1986 116 p
(Contract N00014-85-K-0569)
(AD-A180578) Avail: NTIS HC A06/MF A01 CSCL 08C

This is a study to determine the feasibility of using acoustic instruments to observe upper ocean processes. The processes include surface gravity waves, upper ocean turbulence, Langmuir cells and near currents, and internal waves. The acoustic surface backscatter and the acoustic volume backscatter from bubbles and suspended matter will allow the processes to be observed and tracked. The main issues are spatial resolution, volume coverage, sampling rate, and velocity measurement or tracking accuracy. The acoustic properties of the scatterers were modeled to determine signal detectability, hence volume coverage and resolution. Existing velocity measurement techniques and a new tracking method were also modeled. From all the submodels, a system performance prediction model was constructed, from which recommendations were made regarding sonar configuration, operating frequencies, and other system specifications. GRA

N87-25611*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TESTING AND VALIDATING THE CERES-WHEAT (CROP ESTIMATION THROUGH RESOURCE AND ENVIRONMENT SYNTHESIS-WHEAT) MODEL IN DIVERSE ENVIRONMENTS Technical Report, 1980 - 1985
S. Otter-Nacke, D. C. Godwin, and J. T. Ritchie Dec. 1986 155 p Prepared in cooperation with Agricultural Research Service, Temple, Tex., International Fertilizer Development Center, Muscle Shoals, Ala. and Michigan State Univ., East Lansing
(NASA-TM-89609; JSC-20244; NAS 1.15:89609; PB87-181483; YM-15-00407) Avail: NTIS HC A08/MF A01 CSCL 02C

CERES-Wheat is a computer simulation model of the growth, development, and yield of spring and winter wheat. It was designed to be used in any location throughout the world where wheat can be grown. The model is written in Fortran 77, operates on a daily time stop, and runs on a range of computer systems from microcomputers to mainframes. Two versions of the model were developed: one, CERES-Wheat, assumes nitrogen to be nonlimiting; in the other, CERES-Wheat-N, the effects of nitrogen deficiency are simulated. The report provides the comparisons of simulations and measurements of about 350 wheat data sets collected from throughout the world. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N87-25612 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Systems Group.
SOLAR DYNAMIC POWER SUPPLY FOR ORBITING SYSTEMS WITH FREE-PISTON STIRLING ENGINE
H. Kuczera 1986 8 p Presented at the 37th International Astronautical Federation Congress on Space: New Opportunities for All People, Innsbuck, Austria, 4-11 Oct 1986 Previously announced in IAA as A87-15896 Submitted for publication
(MBB-UR-876/86; IAF-86-145; ETN-87-99938) Copyright Avail: Issuing Activity

It is argued that a free piston Stirling engine with integrated linear alternator has sufficient potential for space power applications. A 1kWe system for Spacelab mission D2 is presented. A flight demonstration experiment is described. Efficiency, pointing accuracy, erosion/degradation, maintenance, and replaceability are discussed. ESA

N87-25613# International Centre for Theoretical Physics, Trieste (Italy).
INVESTIGATION OF ROOM TEMPERATURE OXIDIZED THIN FILMS OF Al FOR PHOTOVOLTAIC APPLICATIONS
G. A. Adegboyega Dec. 1985 8 p
(DE87-701755; IC-85/213) Avail: NTIS (US Sales Only) HC A02/MF A01

Sheet resistance and transmittance changes of thin films of Al evaporated in high vacuum were measured during sorption of oxygen at room temperature. An increase in both sheet resistance and transmittance with a tendency to saturation has been observed. Evaluation of various thicknesses of the films for possible use as transparent electrode material for photovoltaic applications shows that for very thin films (less than 130 A), the unoxidized films are better while for thicker films (greater than or = 200 A) the oxidized films are superior. DOE

N87-25614# California Univ., Los Angeles. School of Engineering and Applied Science.
SEMICONDUCTOR EUTECTIC SOLAR CELL Final Technical Report, Nov. 1976 - Dec. 1978
A. S. Yue and J. G. Yu Dec. 1986 115 p
(Contract F19628-77-C-0021)
(AD-A179773; UCLA-ENG-8008; RADC-TR-86-170) Avail: NTIS HC A06/MF A01 CSCL 20L

Two-phase semiconducting eutectics are potential device-materials. Of these, the SnSe-SnSe2 eutectic was chosen for studies in detail because it consists of multi-p/n-layers of SnSe and SnSe2 semiconductors. Since plasma frequency has not been detected in its infrared reflectance spectrum up to 40 micrometers of wavelength, it suggests that the SnSe-SnSe2 eutectic is a nondegenerate semiconductor. As-grown SnSe2 single crystals have hexagonal crystallographic structure and show n-type conductivity. Polycrystalline SnSe and SnSe2 films have been successfully prepared in vacuum using a close-space-vapor transport technique. GRA

N87-25615# Mechanical Technology, Inc., Latham, N. Y.
FURTHER DEVELOPMENTS IN THE DESIGN OF A FREE-PISTON STIRLING ENGINE HEAT PUMP FOR RESIDENTIAL APPLICATIONS
R. A. Ackermann, J. M. Clinch, and G. T. Privon 1987 25 p Presented at the American Society of Heating, Refrigerating and Air-Conditioning Engineers Meeting, Nashville, Tenn., 28 Jun. 1987 Prepared in cooperation with Gas Research Inst., Chicago, Ill. and ORNL
(Contract DE-AC05-84OR-21400)
(DE87-008581; CONF-870620-3) Avail: NTIS MF A01

During the past year (1986/1987), the development of an improved Stirling engine driver for the Free-Piston Stirling Engine Heat Pump (FPSE/HP) has led to a significant increase in heat pump performance. With the improved engine, named the MARK I, the FPSE/HP has achieved its two critical milestones of producing 3.0 refrigeration tons (RT) at the 35°C (95°F) ambient temperature conditions and an engine efficiency of 25%, as measured from the fuel input energy, based on the higher heating value of the natural gas and mechanical power developed by the engine. This paper describes the latest configuration of the FPSE/HP module and presents measured performance data. Performance has been measured over a broad range of ambient temperature conditions and engine operating parameters. The results obtained from this testing are presented. DOE

N87-25616# Sandia National Labs., Albuquerque, N. Mex.
DEVELOPMENT OF STRESSED MEMBRANE HELIOSTAT MIRROR MODULE Final Report
B. L. Butler, K. Beninga, W. C. Loomis, and P. J. Royval Apr. 1987 213 p
(Contract DE-AC04-76DR-00789)
(DE87-008855; SAND-87-8179) Avail: NTIS HC A10/MF A01

The design of a commercial stressed membrane 150 sq m heliostat mirror module based on thin .0762 mm (.003 in.) stainless steel is reported. The fabrication and initial evaluations of a 50 sq m first of a kind prototype is reported and represents the first proof of principal for this advanced heliostat concept. The baseline design, manufacturing and installation of these vacuum focused double membrane thin drum heliostats has been established. The results of prototype testing will allow the designs and manufacturing scenarios for these 10.7 kg/sq m, 2.2 lb/sq ft, heliostats to be refined and installation costs reduced. DOE

N87-25617# California Univ., Berkeley. Lawrence Berkeley Lab.
ENERGY CONVERSION AND STORAGE PROGRAM, FY 1986 Annual Report
E. J. Cairns Mar. 1987 40 p
(DE87-009270; LBL-22151) Avail: NTIS HC A03/MF A01

Twelve papers are presented, divided into four sections entitled, electrochemical energy storage and conversion, thermal energy storage and conversion, coal-related research, and energy-related chemistry. DOE

N87-25618# Arizona Univ., Tucson.
MECHANISMS OF PHOTOCHEMICAL ENERGY CONVERSION BY CHLOROPHYLL Progress Report, 1 Jul. 1986 - 15 Apr. 1987
G. Tollin 1987 6 p
(Contract DE-FG02-86ER-13631)
(DE87-009431; DOE/ER-13631/1) Avail: NTIS HC A02/MF A01

Oxidized cytochrome c, when bound electrostatically to the surface of negatively-charged bilayer vesicles can function as an electron acceptor from chlorophyll triplet state. We have extended this type of experiment to plastocyanin bound to positively-charged bilayer vesicles. It was shown that plastocyanin is bound to egg phosphatidylcholine vesicles containing 5 to 25 mole percent dioctadecyldimethylammonium chloride (DODAC+) via electrostatic interactions in a 50 mM betaine medium (pH = 6.5). This was demonstrated by both gel filtration experiments and kinetic results using laser flash photolysis. Under those conditions, oxidized plastocyanin can function as a direct electron acceptor from membrane-bound triplet chlorophyll to produce chlorophyll cation radical and reduced plastocyanin. The fraction of chlorophyll triplet which is quenched by oxidized plastocyanin increases, and the yield of electron transfer products also increases, with an increase in the magnitude of the positive charge on the vesicles. DOE

N87-25619# Florida Univ., Gainesville. Dept. of Electrical Engineering.
DLTS ANALYSIS AND MODELING OF ELECTRON AND PROTON IRRADIATED (AlGa)As/GaAs MULTIJUNCTION SOLAR CELLS Final Report, Oct. 1985 - Oct. 1986
Sheng S. Li Mar. 1987 44 p
(Contract F33615-81-C-2058)
(AD-A180234; AFWAL-TR-86-2120) Avail: NTIS HC A03/MF A01 CSCL 07B

A numerical model has been developed to calculate the displacement defects, the damage constant of minority carrier diffusion length and the degradation of short circuit current (I sub sc), open circuit voltage (V sub oc) and conversion efficiency (eta sub c) in the 1 MeV electron and proton irradiated AlGaAs/GaAs/InGaAs multijunction junction solar cell under normal incidence conditions. The results show good agreement between calculated values and the experimental data of I sub sc, V sub oc and eta sub c. In addition, DLTS analysis of defects in AlGaAs p-n junction solar cells irradiated by 1-MeV electrons has also been carried out. The I-V analysis on several MOCVD-grown Ge/GaAs tunnel junction diodes has also been made in this study. GRA

N87-25620# International Fuel Cells Corp., South Windsor, Conn.
FOLLOW-ON 40-kW TEST SUPPORT PROGRAM: 40-kW FUEL CELL FIELD TEST DATA ANALYSIS
S. P. Breen, G. P. Merten, and R. M. Smith Dec. 1986 47 p
(Contract GRI-5080-344-0308)
(PB87-182200; FCR-8244; GRI-87/0010) Avail: NTIS HC A03/MF A01 CSCL 10B

This report examines the accuracy of the simplified analysis methods presented in Application Guide for Fuel Cells in Commercial Buildings for characterizing and understanding the energy requirements of prospective applications for fuel cell energy service. A breakdown of the energy characteristics of buildings in the light industrial sector is also provided. Based on 40-kW fuel cell operating data from the field tests program diagnostic procedures were formulated and the instrumentation required to improve diagnostics for future power plants has been identified. GRA

N87-25621*# Ohio State Univ., Columbus.
WIND TUNNEL EVALUATION OF A TRUNCATED NACA 64-621 AIRFOIL FOR WIND TURBINE APPLICATIONS Final Report
S. P. Law and G. M. Gregorek Jul. 1987 37 p
(Grant NAG3-330)
(NASA-CR-180803; DOE/NASA/0330-2; NAS 1.26:180803)
Avail: NTIS HC A03/MF A01 CSCL 10A

An experimental program to measure the aerodynamic performance of a NACA 64-621 airfoil with a truncated trailing edge for wind turbine applications has been conducted in the Ohio State University Aeronautical and Astronautical Research Laboratory 6 in. by 21 in. pressurized wind tunnel. The blunted or trailing edge truncated (TET) airfoil has an advantage over similar trailing edge airfoils because it is able to streamline a larger spar structure, while also providing aerodynamic properties that are quite good. Surface pressures were measured and integrated to determine the lift, pressure drag, and moment coefficients over angles of attack ranging from -14 to +90 deg at Mach 0.2 and Reynolds numbers of 1,000,000 and 600,000. Results are compared to the NACA 0025, 0030, and 0035 thick airfoils with sharp trailing edges. Comparison shows that the 30 percent thick NACA 64-621-TET airfoil has higher maximum lift, higher lift curve slope, lower drag at higher lift coefficients, and higher chordwise force coefficient than similar thick airfoils with sharp trailing edges. Author

N87-25622# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SERI PV AR/D UNIVERSITY PARTICIPATION PROGRAM Annual Subcontract Report, FY 1986
Apr. 1987 85 p
(Contract DE-AC02-83CH-10093)
(DE87-001174; SERI/STR-211-3147) Avail: NTIS HC A05/MF A01

The first annual technical progress reports of the five initial university photovoltaic research centers are contained. These five projects were started under a competitive procurement for the Solar Energy Research Institute. These progress reports include the following studies: New Approach for High Efficiency Solar Cell by MOCVD (North Carolina State University); Electronic Processes in Thin Film PV Materials (University of Utah); Low Temperature MOCVD Growth Processes for High Efficiency Solar Cells (University of Southern California); Ion Beam Doping of II-VI Compounds During Physical Vapor Deposition (Standford University); and Rapid Liquid Phase Epitaxy of III-V Semiconductors (Brown Univeristy). For individual titles, see N87-25623 through N87-25627.

N87-25623# North Carolina State Univ., Raleigh. Dept. of Electrical and Computer Engineering.
NEW APPROACH FOR HIGH EFFICIENCY SOLAR CELL BY MOCVD Annual Report, Oct. 1985 - Sep. 1986
S. M. Bedair *In* Midwest Research Inst., SERI PV AR/D University Participation Program Apr. 1987 p 1-12 (For primary document see N87-25622 19-44)
Avail: NTIS HC A05/MF A01

Approaches are being developed to use strained layer supperlattices (SLS) both as buffer and active layers in solar cell structures. The SLS buffer is used to reduce the density of defects originating from GaAs substrates and from GaAs grown on Si substrates. The SLS was included as a part of p-n junction to extend photon absorption beyond the bandgap of GaAs without the introduction of lattice defects. GaAs(1-y)P(y)-In(x)Ga(1-x)As SLS with y = 2X has an average lattice constant equal to that of GaAs. These SLSs when used as buffer layers resulted in significant reductions in defects originating from the substrate by at least two orders of magnitudes. Initial results also indicate that this SLS is effective in filtering dislocations present in GaAs grown on Si substrates. P-n junction solar cells were fabricated in GaAsP-InGaAs SLS. This allows the extension of the spectral response to about 0.95 micron, beyond that of GaAs. Open circuit voltage of about 0.9 V was also measured for the SLS solar cell. These results can have an impact on the performance of low bandgap cells in the cascade cell structure. Author

N87-25624# Utah Univ., Salt Lake City. Dept. of Physics.
ELECTRONIC PROCESSES IN THIN FILM PV MATERIALS Annual Technical Status Report, 1 Sep. 1985 - 31 Aug. 1986
P. C. Taylor, M. Gal, G. A. Williams, and W. D. Ohlsen *In* Midwest Research Inst., SERI PV AR/D University Participation Program Apr. 1987 p 13-53 (For primary document see N87-25622 19-44)
Avail: NTIS HC A05/MF A01

One important class of materials for PV conversion of solar energy is the group of thin film amorphous semiconductors based on hydrogenated amorphous silicon (a-Si:H). Important alloys include a-Si(x)Ge(1-x):H and a-Si(x)C(1-x):H which are used to produce narrower gaps for tandem cells and lower band gaps for top-surface p-layers, respectively. Currently little is known concerning the defects and impurities which create enhanced densities of electronic states in the gap in these films. In addition, both the alloys and a-Si:H itself are currently plagued by electronically and optically induced mestabilities (Staebler-Wronski effect). The metastabilities adversely affect device performance and make projections of useful device lifetimes difficult. The roles of defects and impurities in this class of thin films are characterized. The quality of the interfaces and junctions which occur in PV devices are determined by employing surface-sensitive optical and resonant techniques. Another important objective is to understand the electronic metastabilites in the amorphous thin films. Author

N87-25625# University of Southern California, Los Angeles.
LOW TEMPERATURE MOCVD GROWTH PROCESSES FOR HIGH EFFICIENCY SOLAR CELLS Annual Report no. 1, 1 Sep. 1985 - 31 Aug. 1986
P. D. Dapkus *In* Midwest Research Inst., SERI PV AR/D University Participation Program Apr. 1987 p 55-68 (For primary document see N87-25622 19-44)
Avail: NTIS HC A05/MF A01

The problems encountered in the fabrication of high-efficiency, low-cost cells by the MOCVD process as it is currently practiced, are addressed. Detailed information on the rates of decomposition of the primary reactants used in the MOCVD growth of GaAs were measured. In addition progress was made in the establishment of a facility to understand the growth processes operative in MOCVD by the construction of a sampling gas mass spectrometer and an XPS system with an integral reaction chamber. A plan was described by which this apparatus would be used to investigate further the MOCVD growth progress and to develop a low temperature process for the growth of solar cells. B.G.

N87-25626# Stanford Univ., Calif. Dept. of Materials Science.
ION BEAM DOPING OF II-VI COMPOUNDS DURING PHYSICAL VAPOR DEPOSITION
R. H. Bube *In* Midwest Research Inst., SERI PV AR/D University Participation Program Apr. 1987 p 69-75 (For primary document see N87-25622 19-44)
Avail: NTIS HC A05/MF A01

Ion-assisted physical vapor deposition of CdTe and other II-VI compounds was investigated. One aspect of this is to determine the influences of ionized dopant atoms on the growth, structural, and photoelectronic properties of the deposited film. The other aspect is to investigate the morphology, structure, and electrical properties of films grown from an ionized flux of the major constituents of the II-VI films. Author

N87-25627# Brown Univ., Providence, R. I.
RAPID LIQUID PHASE EPITAXY OF III-V SEMICONDUCTORS **c76**
J. T. Daly, H. J. Gerritsen, E. E. Crisman, and S. K. F. Karlsson *In* Midwest Research Inst., SERI PV AR/D University Participation Program Apr. 1987 p 77-83 (For primary document see N87-25622 19-44)
Avail: NTIS HC A05/MF A01

A technique for liquid phase epitaxy (LPE) of III-V semiconductors is currently under development. This method utilizes a saturated solution in laminar flow across the substrate surface to achieve time-independent growth rates that are calcualted to be on the order of 50 times higher than in conventional LPE methods. This growth technique is expected to have applications in reducing the production cost of simple epitaxial structures such as photovoltaic devices. The method is briefly described. Plans for the near future include extension of this method to growth of GaAs at 600 C. The advantage of the lower growth temperature, while maintaining reasonable growth rate, is that unwanted impurity incorporatin and thermal stress induced dislocation density are expected to be lower than if the layers were grown at higher temperatures. B.G.

N87-25628# Technische Univ., Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
DESIGN OF MORE POWERFUL SOLAR ENERGY SYSTEMS FOR APPLICATION IN SPACE Ph.D. Thesis [ZUR AUSLEGUNG LEISTUNGSSTARKER SONNENENERGIE-ANLAGEN FUER DEN EINSATZ IM WELTRAUM]
Peter Panagopoulos 1985 128 p In GERMAN
(ETN-87-99348) Avail: NTIS HC A07

The weight optimization of powerful solar power plants for application in space was studied. The radiator temperatures resulting from the maximum process temperatures are realizable with relatively low technological effort for systems with a Carnot or Rankine process. The thermodynamic efficiency of Carnot systems is found to be substantially higher than that of systems with real processes, whose global efficiency is very low. For all systems the mirror has the largest mass, followed by the radiator. The power-weight ratio of mirror systems is larger than that of solar cell systems. For solar mirror systems with variable distance to the Sun only parabolic systems which hardly deform during accelerations are suited. ESA

N87-25629# Poly Solar, Inc., Garland, Tex.
DEPOSITION OF COPPER INDIUM DISELENIDE FILMS BY LOW-COST TECHNIQUES Final Subcontract Report, 15 Nov. 1983 - 14 Sep. 1985
Feb. 1987 34 p Prepared for Midwest Research Inst., Golden, Colo.
(Contract DE-AC02-83CH-10093)
(DE87-001151; SERI/STR-211-3123) Avail: NTIS HC A03/MF A01

This is the final technical report of a research program on copper indium diselenide films. The objectives of this program were to prepare device-quality, thin-film, polycrystalline CuInSe2 by low-cost techniques and to produce heterojunction solar cells 1 sq cm in area with an AM 1 efficiency of 8% or higher. In this

work, three approaches were used to deposit p-type CuInSe2 films: close-spaced chemical vapor transport (CSCVT), thermal reduction of Cu and In compounds followed by selenization, and electroplating of Cu and In films followed by selenization. The important process parameters for: (1) depositing CuInSe2 films by the CSCVT technique, (2) depositing Cu-In films by chemical reduction and electroplating, and (3) forming CuInSe2 films by the selenization of Cu-In films were investigated. Many p-CuInSe2 films were deposited on conducting and insulating substrates and their properties characterized. Heterojunction solar cells were fabricated from p-CuInSe2 films prepared by the three techniques, and their photovoltaic characteristics evaluated. The procedures and results are summarized. Author

N87-25630*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBINATION PHOTOVOLTAIC-HEAT ENGINE ENERGY CONVERTER Patent Application
Donald L. Chubb, inventor (to NASA) 9 Jul. 1987 10 p
(NASA-Case-LEW-14252-1; US-Patent-Appl-SN-071678) Avail: NTIS HC A02/MF A01 CSCL 10B

A combination photovoltaic array heat engine solar energy converter that converts the entire solar spectrum into electrical energy is disclosed. Photons from the solar spectrum of predetermined wavelengths are directed to the photovoltaic array and convertied to electrical energy. Also, a combination of electrical energy and thermal energy storage is provided to insure electrical power throughout the spacecraft orbit. NASA

N87-25895*# South Carolina Univ., Columbia. Dept. of Mechanical Engineering.
HIGH TEMPERATURE ELECTROLYZER/FUEL CELL POWER CYCLE: PRELIMINARY DESIGN CONSIDERATIONS
Jeffrey H. Morehouse *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 45 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 45 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 10B

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N87-25631# Hahn-Meitner-Institut fuer Kernforschung, Berlin (West Germany). Bereich Datenverarbeitung und Elektronik.
NUMERICAL MODELS FOR THE COMPUTATION OF POLLUTANT DISPERSION IN THE ATMOSPHERE
Silke Marie Leder and Angelika Biesemann-Krueger Apr. 1985 161 p In GERMAN; ENGLISH summary
(HMI-B-432; ETN-87-99662) Avail: NTIS HC A08/MF A01

Models used to compute the concentration of emitted pollutants in the lower atmosphere are described. The Gauss model and the unsteady model are presented. A dispersion model was developed and its convergence was investigated. Comparisons with numerical test results and dispersion experiments show good agreement. ESA

N87-25632# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.
NOAA/GMCC (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION/GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE) CALIBRATIONS OF CO2-IN-AIR REFERENCE GASES, 1979-1985
K. W. Thoning, P. Tans, T. J. Conway, and L. S. Waterman Jan. 1987 68 p Prepared in cooperation with Colorado Univ., Boulder
(PB87-164992; NOAA/TM-ERL-ARL-150) Avail: NTIS HC A04/MF A01 CSCL 13B

The results of 423 CO2-in-air reference gas calibrations from 1979 to 1985 are presented. Time dependent concentrations for the NOAA secondary and tertiary standards are plotted and tabulated. A preliminary analysis of the uncertainty of the assigned CO2 concentrations for reference gases used in the field for atmospheric measurements gives values of 0.07 ppm relative to the World Meteorological organization scale. GRA

N87-25633# Space and Missile Test Center, Patrick AFB, Fla.
PROBLEMS AND SUGGESTED SOLUTIONS RELATED TO DISPERSION FORECASTING UNDER SEA BREEZE CONDITIONS Final Report
B. F. Boyd and T. L. Wilfong 5 May 1987 11 p
(AD-A180326; ESMC-TR-87-04) Avail: NTIS HC A02/MF A01 CSCL 08C

Problems in forecasting toxic effluent dispersion under sea breeze conditions at Cape Canaveral are examined. Land and sea breezes are fairly well understood in a general sense; however, in order to forecast dispersion and transport of toxic effluents or to assess the impact of a major accident in a coastal region, smaller scale features of the sea or land breeze must be considered. A case study is presented to demonstrate the problem. Important small scale features associated with a land or sea breeze must be observed and measured before they can be effectively modeled. Such measurements must employ techniques that yield observations with high spatial and temporal resolution. Techniques using Sound Detection And Ranging (SODAR) And Light Detection And Ranging (LIDAR) are proposed as possible methods to provide high resolution measurements of the Cape Canaveral sea and land breeze. GRA

N87-25634# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.
REVIEW OF CONTROL STRATEGIES FOR OZONE AND THEIR EFFECTS ON OTHER ENVIRONMENTAL ISSUES
E. L. Meyer Nov. 1986 117 p
(PB87-171195; EPA-450/4-85-011) Avail: NTIS HC A06/MF A01 CSCL 13B

The review summarizes theoretical, experimental, field and modeling data related to effects of reducing volatile organic compounds (VOC), oxides of nitrogen (NOx) or both for meeting the ambient air quality standard for ozone (O3). Implications are reviewed for several environmental concerns. These include O3 levels within and immediately downwind of major sources of precursors (i.e., cities), O3 concentrations in rural/remote areas, ambient levels of nitrogen dioxide (NO2), acidic species formation and visibility attenuation. GRA

N87-25635*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
AN EVALUATION OF RAIN CHEMISTRY DATA FOR THE JOHN F. KENNEDY SPACE CENTER, FLORIDA AND THE UNIVERSITY OF CENTRAL FLORIDA, ORLANDO
Brooks C. Madsen, Thomas W. Dreschel, and C. Ross Hinkle (Bionetics Corp., Cocoa Beach, Fla.) Oct. 1986 26 p
(Contract NAS10-10285)
(NASA-TM-100301; NAS 1.15:100301) Avail: NTIS HC A03/MF A01 CSCL 13B

Concern over the effects of Space Shuttle launches prompted the initiation of a rather intense environmental monitoring program. The program included a precipitation monitoring network with 13 precipitation collection sites which were operated for various time periods to baseline precipitation chemistry at the John F. Kennedy Space Center (KSC). One additional site was also established as a remote background site on the Univ. of Central Florida (UCF) campus. One of the 13 sites was converted to a National Atmospheric Deposition Program (NADP) station. Collections and analyses of samples were performed using a number of methodologies during the monitoring period. An evaluation of the data for comparability and utility for acid rain research was performed using the anion/cation, measured conductivity, calculated conductivity, Cl/Na, and Mg/Na ratios. Data collected at all KSC sites between 1977 and 1981, from 1983 to 1985 at

the NADP site and at UCF to 1985 are comparable and appropriate for determining acid rain trends. Examination of those comparable data showed a fairly stable pH between 1977 and 1982 and an increase of 0.2 pH units which was observed as an incremental increase between 1982 and 1983 at KSC and UCF. Author

N87-25636*# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
THE DETECTION AND INTERPRETATION OF LONG-TERM ATMOSPHERIC CHANGE: TASKS IN ASSOCIATION WITH THE SHUTTLE SOLAR BACKSCATTER ULTRAVIOLET SPECTRAL RADIOMETER Semiannual Status Report
John E. Frederick 5 Aug. 1987 12 p
(Grant NAG5-873)
(NASA-CR-180521; NAS 1.26:180521) Avail: NTIS HC A02/MF A01 CSCL 13B

The objectives are to develop techniques to detect and remove long-term instrument drifts from the operational Solar Backscatter Ultraviolet (SBUV/2) data base using periodic measurements made by the Shuttle Solar Backscatter Ultraviolet Spectral Radiometer and to evaluate the potential effects of scattering by atmospheric aerosols on our ability to detect trends in ozone using SBUV-class instruments. Author

N87-25637*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ENVIRONMENTAL PROJECTS. VOLUME 1: POLYCHLORINATED BIPHENYL (PCB) ABATEMENT PROGRAM Final Report
L. Kushner 15 Mar. 1987 136 p
(Contract NAS7-918)
(NASA-CR-180388; JPL-Pub-87-4-Vol-1; NAS 1.26:180388)
Avail: NTIS HC A07/MF A01 CSCL 13B

Six large parabolic dish antennas are located at the Goldstone Deep Space Communications Complex north of Barstow, California. Some of the ancillary electrical equipment of thes Deep Space Stations, particularly transformers and power capicitors, were filled with stable, fire-retardant, dielectric fluids containing substances called polychlorobiphenyls (PCBs). Because the Environmental Protection Agency has determined that PCBs are environmental pollutants toxic to humans, all NASA centers have been asked to participate in a PCB-abatement program. Under the supervision of JPL's Office of Telecommunications and Data Acquisition, a two-year long PCB-abatement program has eliminated PCBs from the Goldstone Complex. Author

N87-25638*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ENVIRONMENTAL PROJECTS. VOLUME 2: UNDERGROUND STORAGE TANKS COMPLIANCE PROGRAM
L. Kushner 15 Jun. 1987 144 p
(Contract NAS7-918)
(NASA-CR-180903; JPL-Pub-87-4-Vol-2; NAS 1.26:180903)
Avail: NTIS HC A07/MF A01 CSCL 13B

Six large parabolic dish antennas are located at the Goldstone Deep Space Communications Complex north of Barstow, California. As a large-scale facility located in a remote, isolated desert region, the GDSCC operations require numerous on-site storage facilities for gasoline, diesel and hydraulic oil. These essential fluids are stored in underground storage tanks (USTs). Because USTs may develop leaks with the resultant seepage of their hazardous contents into the surrounding soil, local, State and Federal authorities have adopted stringent regulations for the testing and maintenance of USTs. Under the supervision of JPL's Office of Telecommunications and Data Acquisition, a year-long program has brought 27 USTs at the Goldstone Complex into compliance with Federal, State of California and County of San Bernadino regulations. Of these 27 USTs, 15 are operating today, 11 have been temporary closed down, and 1 abandoned in place. In 1989, the 15 USTs now operating at the Goldstone DSCC will be replaced either by modern, double-walled USTs equipped with automatic sensors for leak detection, or by above ground storage tanks. The 11 inactivated USTs are to be excavated, removed and disposed of according to regulation. Author

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; inospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N87-25639# Meyer (W.), Langen (West Germany).
STUDY TO INVESTIGATE THE HEIGHT OF THE EARTH'S INFRARED HORIZON
W. Meyer Paris, France ESA Mar. 1986 58 p
(Contract ESA-5761/83-D-IM(SC))
(ESA-CR(P)-2345; ETN-87-99885) Avail: NTIS HC A04/MF A01

The coverage changes of five ESA satellites equipped with two different IR pencil beam sensor types are analyzed. A mathematical model is derived to predict the apparent angular distance between the scan cone (described by the optical axis of the sensor) and the edge of the Earth disk, at the time of the first/last pulse triggering. ESA

N87-25640# SASC Technologies, Inc., Lexington, Mass.
ALTERNATIVE FORMS OF MOISTURE INFORMATION IN 4-D DATA ASSIMILATION
Donald C. Norquist 15 Sep. 1986 144 p
(Contract F19628-82-C-0023)
(AD-A179792; AFGL-TR-86-0194; SR-11) Avail: NTIS HC A07/MF A01 CSCL 04A

Global data analysis procedures were developed to perform data assimilation for observed geopotential heights, wind components, and relative humidity. This report describes in detail the design of these computer codes and their implementation in conjunction with a 6h global spectral forecast model (GSM) and normal mode initialization. The three procedures together form the AFGL Global Data Assimilation System (AGDAS) which was used in a series of data assimilation experiments to assess the impact of several alternative sources of humidity information used in the relative humidity analysis. Each alternative humidity source was investigated as to reliability of information content in a collocation study against rawinsonde relative humidity. Satellite moisture retrievals, surface weather observations, and AFGWC 3DNEPH cloud amounts were used to deduce upper air relative humidity. The latter two were found in sufficiently good agreement with rawinsonde relative humidity to permit their use in the data assimilation. The 3DNEPH inferred humidities, and to a lesser extent the surface weather observation inferred humidities, resulted in an improved analysis over maintaining the first guess when both were compared with verifying observations. Finally, the sensitivity of the AFGL GSM to initial humidity states was tested by initializing a series of 48h forecasts from several humidity fields. GRA

N87-25641# Regis Coll., Weston, Mass.
A STUDY OF PLASMA IRREGULARITIES IN THE HIGH-LATITUDE REGION Final Report, 19 Jun. 1984 - 30 Sep. 1986
D. R. Weimer, P. B. Anderson, M. E. Greenspan, E. M. Basinska-Lewin, and J. H. James 27 Oct. 1986 106 p
(Contract F19628-84-C-0126)
(AD-A179910; AFGL-TR-86-0233) Avail: NTIS HC A06/MF A01 CSCL 04A

A summary is given of the work completed under contract F19628-84-C-0126. This work included the engineering of space qualified instruments, data processing services, and scientific study of high latitude plasma irregularities and the physics of the aurora. Design work has been done on a series of plasma instruments for the Defense Meteorological Satellite Program (DMSP), the combined Release and Radiation Effects Satellite (CRRES), the Beam Ejection Rocket Technology (BERT) and Ejected Rocket

Nosecone to measure Induced Emissions (ERNIE) sounding rocket program, and the Interactions Measurements Payload for Shuttle (IMPS). The function of the Special Sensor for Ions, Electrons, and Scintillations (SSIES) is described in detail. Computer programs have been written to process DMSP magnetometer data, and DMSP plasma density measurements have been processed to produce a model of the topside ionosphere. A scientific study has been conducted with HILAT data in order to produce an empirical description of high-latitude plasma irregularity production and transport. Data from HILAT has also been used to study small scale processes on the auroral dayside cusp region. Both HILAT and Dynamics Explorer 1 data have been used to study auroral electrodynamics in the ionosphere and above to auroral acceleration region. Research is in progress on a study of the coupling between the magnetotail and the auroral ionosphere using data from both the European Incoherent Scatter radar facility (EISCAT) and the Active Magnetosphere Particle Tracer Explorer Ion Release Module (AMPTEIRM).

N87-25642# Middleton (David), New York.
A PROPOSED SOLITON MECHANISM IN WIND-WAVE SURFACE GENERATION AND SCATTERING Technical Report, Nov. 1985 - Jun. 1986
David Middleton 19 Dec. 1986 61 p
(Contracts N66604-85-B-09J; N00140-83-D-SK59; N00140-84-M-MN82)
(AD-A179918; NUSC-TR-7775) Avail: NTIS HC A04/MF A01 CSCL 20A

Initially, to account for observed discrepancies in acoustic backscatter strengths and Doppler shifts, and subsequently, to provide a plausible model of local wind-wave surface generation, a soliton mechanism has been proposed, which appears to play a critical role under the following operating conditions: small grazing angles, high frequencies, and moderate strong wind speeds, in bubble-free regimes. Earlier versions of the proposed soliton surface, which is postulated to be a part of the wind-generated surface drift layer, are extended in this study to include the effects of surface tension, as well as many physical and analytical features. Surface tension is a dominant factor, setting a minimum thickness, he-min, of 5.5 mm, to the effective drift layer or channel which supports the soliton ensemble. Layer thickness (7 to 8 mm) and soliton speeds (30 cm/s) appear typical at (mean) near-surface wind speeds U sub infinity 10 m/s. Key features of these solitons (or hydraulic bumps = one-sided waves), which comprise the high wavenumber components of the total surface, including the gravity-capillary structure on which the wind-generated soliton ensemble rides, are: (1) their nondispersive nature, (2) their independence, reflecting the fact that solitons can travel through one another without distortion; and (3) that they are (in the unidimensional models) limiting solutions of the Kortweg-de Vries equation. GRA

N87-25643# Naval Ocean Systems Center, San Diego, Calif.
INFRARED SKY RADIANCE DISTRIBUTIONS IN THE MARINE BOUNDARY LAYER Interim Report
W. J. Schade and D. Law Jan. 1987 25 p
(AD-A180050; NOSC-TD-1032) Avail: NTIS HC A02/MF A01 CSCL 07C

This report describes an alternative method for inferring the effects of aerosols on atmospheric transmittance. Spatial distributions of infrared sky radiance in the 3 to 5 micrometer (SWIR) and 8 to 12 micrometer (LWIR) spectral bands were measured at low elevation angles above the sea surface, then compared with the corresponding clear sky radiance. The infrared aerosol transmittance was inferred from the ratio of measured radiance to calculated clear sky radiance along the horizon line of sight (LOS). Results show that only the LWIR band can be used to infer aerosol transmittance reliably. The radiance along the horizon LOS originates predominately in the lowest 100 m of the atmosphere; therefore, reasonably accurate horizon radiance of transmittance predictions could be made from meteorological data within this low altitude. GRA

N87-25644# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
EVALUATION OF GRAVITY DATA WITHIN THE DEPARTMENT OF DEFENSE GRAVITY LIBRARY
Kathryn L. Hille Jun. 1987 45 p
(AD-A180191) Avail: NTIS HC A03/MF A01 CSCL 08E

The Department of Defense Gravity Library (DODGL) maintains an automated file of worldwide surface gravity observations. The gravity information in the database has been acquired from numerous sources including many scientific and government organizations, educational institutions, and private companies. To establish the quality of the gravity data in the database the data is subjected to review and evaluation and referenced to a common datum, the International Gravity Standardization Net of 1971 (IGSN 71). The data evaluation process is designed to eliminate duplicate data and reduce errors to a minimum. Error sources include instrument and recording errors, horizontal or vertical positioning errors, data correction (reduction) errors, and uncertainties in base station connections and the IGSN 71. Relationships and fit between individual data sets are also a consideration. Based on results from the evaluation process, gravity data is deleted, modified, or adjusted to obtain the most error free data possible. An accuracy value is assigned to each gravity observation based upon all findings from the evaluation. When the evaluation of a data set has been completed, the database is updated to reflect the evaluated data. Due to ongoing gravity data acquisition, evaluation is a continuing process. GRA

N87-25645# Analytic Sciences Corp., Reading, Mass.
INDEPENDENT ANALYSIS OF GRAVITY GRADIOMETER SURVEY SYSTEM (GGSS) DEVELOPMENT AND DEPLOYMENT: A SYNOPSIS Final Report, Feb. 1983 - Feb. 1986
Steven J. Brzezowski and Warren G. Heller Aug. 1986 32 p
(Contract F19628-83-C-0053)
(AD-A180267; TASC-TR-4423-6; AFGL-TR-86-0173) Avail: NTIS HC A03/MF A01 CSCL 08E

This final report reviews the development and deployment of the Gravity Gradiometer Survey System (GGSS). The primary areas addressed during the research effort consisted of specification evaluation, test procedures, definition, optimum survey planning, initialization and calibration procedures review, and data analysis. Particularly important results of the effort include: (1) identifying that there was no need to include a master inertial navigation system in the GGSS mechanization; (2) understanding and quantifying the significance of all known error sources on GGSS survey accuracy; and (3) designing and developing a practical algorithm for reducing airborne GGSS data (the template algorithm). GRA

N87-25646# Alaska Univ., Fairbanks. Geophysical Inst.
PI2 PULSATIONS AND THE WESTWARD TRAVELING SURGE IN THE MAGNETOSPHERE-IONOSPHERE COUPLING Final Report, 15 Nov. 1985 - 30 Sep. 1986
J. R. Kan Nov. 1986 25 p
(Contract F19628-85-K-0012)
(AD-A180270; AFGL-TR-86-0244) Avail: NTIS HC A02/MF A01 CSCL 04A

The dynamics of the westward travelling surge (WTS) is studied in a magnetosphere-ionosphere coupling model. It is shown that the motion of the WTS is governed by the combined effects of the magnetospheric Alfven time scale and the ionospheric recombination time scale. The surge is found to move at variable speeds: the speed is around 6 km/sec westward and less than 1 km/sec northward near the onset of the surge; thereafter, it oscillates irregularly and decreases toward zero. The polar cap potential difference is found to oscillate irregularly as it increases toward the enhanced convection level. The irregular oscillations found in our results are believed to be a general property of mulit-time-scale problems. GRA

N87-25647# Research and Data Systems, Inc., Lanham, Md.
DETERMINING LARGE SCALE TENDENCY TERMS FOR THE NAVY OVER-WATER LOCAL ATMOSPHERIC PREDICTION SYSTEM (NOWLAPS) Final Report, 18 Dec. 1985 - 30 Sep. 1986
Philip Ardanuy and Lanning Penn Apr. 1987 69 p
(Contract N00228-84-D-3155; R35-80)
(AD-A180538; NOSC-CR-87-07) Avail: NTIS HC A04/MF A01 CSCL 04B

A manual method for calculating large scale tendency (LST) terms for the Navy Over-Water local Atmospheric Prediction System (NOWLAPS) is adapted from an automated, central-site method utilizing forecast fields from the Navy Operational Global Atmospheric Prediction System (NOGAPS). This report describes the design and use of the LST terms, and compares NOWLAPS predictions for an oceanic weather station ship to those of the Navy Operational Local Atmospheric Prediction System (NOLAPS) and persistence. NOWLAPS, a one-dimensional planetary layer (PBL) model, is designed primarily for shipboard use and was adapted to the Hewlett-Packard 9845 computer under a previous contract. Although it can be run as a single-station PBL forecast model, NOWLAPS can not be a competitive forecast tool until horizontal advection is included or parameterized. GRA

N87-25648# Colorado Univ., Boulder. Dept. of Chemical Engineering.
A GALERKIN-FINITE ELEMENT TECHNIQUE FOR SMALL-SCALE ATMOSPHERIC FLOWS AND TRANSPORT OVER GENERAL TERRAIN Final Report, 1 Aug. 1983 - 31 Jan. 1987
R. L. Sani 15 Apr. 1987 30 p
(Contract DAAG29-83-K-0112)
(AD-A180556; Rept-153-1925; ARO-20162.5-GS) Avail: NTIS HC A03/MF A01 CSCL 20D

A consistent penalty Galerkin finite element algorithm for nonhydrostatic, small scale atmospheric flows over complex terrain is described. The implementation of a quasi Newton and an appropriate factorization technique is discussed. Finally, the implementation of an adaptive mesh technique suitable for front tracking encountered, for example, in certain free and/or moving boundary problems is discussed. Illustrative simulations are presented. GRA

N87-25649# National Academy of Sciences - National Research Council, Washington, D. C. Polar Research Board.
ANTARCTIC SOLID-EARTH SCIENCES RESEARCH: A GUIDE FOR THE NEXT DECADE AND BEYOND Final Report
1986 49 p Sponsored by NSF
(PB87-172193) Avail: NTIS HC A03/MF A01 CSCL 08G

After having examined major accomplishments in Antarctic science since the International Geophysical Year, and creating an outline of basic scientific research program needs for the remainder of the century (see earlier, 1983 report, Research Emphases for the U.S. Antarctic Program), the Board focused on considerations for developing a long-range scientific plan for the twenty-first century and beyond. The report is structured in outline form to briefly present major considerations about Antarctic science, on a discipline-by-discipline basis. Neither disciplines covered, nor individual objectives or goals are listed according to priority. GRA

N87-25650# National Center for Atmospheric Research, Boulder, Colo.
PROCEDURES FOR REDUCTION OF Fe XII 10747 A CORONAL EMISSION-LINE POLARIZATION OBSERVATIONS
J. Arnaud and G. Newkirk Jan. 1987 25 p
(Grant NSF ATM-82-17015)
(PB87-173605; NCAR/TN-278-STR) Avail: NTIS HC A02/MF A01 CSCL 04A

This note documents the reducing procedures used to obtain the best estimates of the coronal Stokes parameters from the raw measurements recorded in two spectral channels with the High Altitude Observatory Sacramento Peak Observatory Coronal Emission-line Polarimeter (KELP). The original reduction programs have been modified to survey the KELP data as a whole and to help determine whether corrections are needed for each scan. GRA

N87-25651# National Geophysical Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 510, FEBRUARY 1987. PART 1: (PROMPT REPORTS). DATA FOR JANUARY 1987, DECEMBER 1986 AND LATE DATA
H. E. Coffey Feb. 1987 99 p
(Contract N00014-86-F-0049)
(PB87-181194; SGD-510-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 04A

Solar-geophysical data contained include: detailed index for 1986 to 1987; data for January 1987 (advance and worldwide IUWDS alert periods; solar activity indices, solar flared, solar radio emission, Standord mean solar magnetic field); data for December 1986 (solar active regions, sudden ionospheric disturbances, solar radio spectral observations, cosmic ray measurements by neutron monitor, geomagnetic indices, radio propagation indices); and late data (solar radio emission December 1986, cosmic ray measurements by neutron monitor, and geomagnetic indices). GRA

N87-25652# National Geodetic Survey, Rockville, Md.
GEODETIC GLOSSARY
Sep. 1986 283 p
(PB87-181210; LC-86-61105) Avail: NTIS HC A13/MF A01 CSCL 08G

This glossary is a revision of Definitions of Terms Used in Geodetic and Other Surveys (U.S. Coast and Geodetic Survey Special Publication 242) by Hugh C. Mitchell, published in 1948 by the U.S. Government Printing Office. Since this book appeared, the standards, instruments, theory, and procedures of that time have been markedly changed, complemented, reduced in importance, or completely replaced by new ones. In addition, the interaction of geodesy with other disciplines has greatly increased, which demands that these relationships be covered also. Such a variety of changes and additions has swelled the number of definitions from 800 to almost 5000. GRA

N87-25653*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATLAS OF TOMS OZONE DATA COLLECTED DURING THE GENESIS OF ATLANTIC LOWS EXPERIMENT (GALE), 1986
David E. Larko (Research and Data Systems, Inc., Lanham, Md.), Louis W. Uccellini, and Arlin J. Krueger Nov. 1986 99 p
(NASA-TM-87809; NAS 1.15:87809) Avail: NTIS HC A05/MF A01 CSCL 04A

Data from the TOMS (Total Ozone Mapping Spectrometer) instrument aboard the Nimbus-7 satellite were collected daily in real time during the GALE (Genesis of Atlantic Lows Experiment) from January 15 through March 15, 1986. The TOMS ozone data values were processed into GEMPAK format and transferred from the Goddard Space Flight Center to GALE operations in Raleigh-Durham, NC, in as little as three hours for use, in part, to direct aircraft research flights recording in situ measurements of ozone and water vapor in areas of interest. Once in GEMPAK format, the ozone values were processed into gridded form using the Barnes objective analysis scheme and contour plots of the ozone created. This atlas provides objectively analyzed contour plots of the ozone for each of the sixty days of GALE as well as four-panel presentations of the ozone analysis combined on the basis of GALE Intensive Observing Periods (IOP's). Author

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N87-25654# World Meteorological Organization, Geneva (Switzerland).
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE RESULTS OF THE GLOBAL WEATHER EXPERIMENT AND THEIR IMPLICATIONS FOR THE WORLD WEATHER WATCH, VOLUME 2 Global Atmospheric Research Program
Apr. 1986 392 p Conference held in Geneva, Switzerland, 27-31 May 1986 Prepared in cooperation with ICSU, Rome, Italy (WMO-TD-107-Vol-2; GARP-Publ-26-Vol-2; ETN-87-99178)
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Progress in dynamical prediction and the application to weather forecasting; progress in tropical meteorology; application of the results of the Global Weather Experiment to the development of the World Weather Watch; application of the results of the Global Weather Experiment to weather prediction research; and the impact of the Global Weather Experiment on the development of the World Weather Watch and operational numerical prediction by national meteorological services were discussed. For individual titles, see N87-25655 through N87-25676.

N87-25655# World Meteorological Organization, Geneva (Switzerland).
RECENT IMPROVEMENTS IN NUMERICAL WEATHER PREDICTION
B. J. Mason *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 295-311 (For primary document see N87-25654 19-47)
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Improvements in the accuracy of global and hemispheric numerical weather forecasts over the last decade were assessed in terms of the forecast errors of the mass and wind fields for the model used by the United Kingdom Meteorological Office from 1968 to 1984 and by the European Center for Medium Range Weather Forecasts from 1980 to 1984. Performance is judged in terms of rms errors or correlation coefficients expressing differences between predicted and analyzed fields and, more meaningfully, by the ratio of the rms forecast errors to those of the corresponding persistence (zero skill) forecast. Numerical predictions are judged to give little useful guidance to synoptic-scale developments if this ratio exceeds 0.75. ESA

N87-25656# Bureau of Meteorology, Melbourne (Australia).
ADVANCES IN SOUTHERN HEMISPHERE WEATHER PREDICTION AND THE FIRST GARP GLOBAL EXPERIMENT
D. J. Gauntlett *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 313-342 (For primary document see N87-25654 19-47)
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The status of weather prediction in the Southern Hemisphere is reviewed against the historical background of the situation prior to the First GARP Global Experiment (FGGE) and the incremental improvements which occurred as a result of enhanced observations and research inspired by the FGGE. The improvements extend practical predictability limits in the Southern Hemisphere from the 36 to 48 hr prior to FGGE, to the current 4 days. Significant improvements are also evident in short range prediction accuracy and the range of phenomena to which deterministic forecasting methods can successfully be applied. Large scale deterministic prediction methods still show deficiencies in the Southern Hemisphere. The rectification of the deficiencies requires the retention of FGGE observational advances within the World Weather Watch. ESA

N87-25657# Florida State Univ., Tallahassee. Dept. of Meteorology.
DEVELOPMENTS IN TROPICAL ANALYSIS AND PREDICTION RESULTING FROM GARP
T. N. Krishnamurti *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 345-380 (For primary document see N87-25654 19-47)
(Grants NSF KRIS-ATM-83-04809-02; NOAA-NA82AA-D-00004)
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The GARP FGGE analyses, satellite radiance data, sea surface temperature measurements, and numerical prediction experiments in the tropics are reviewed. Satellite radiance data provided useful measures of large scale precipitation rates and of divergent wind, especially over data sparse tropical areas. The FGGE effort also provided improved regional analysis of the humidity field with the utilization of the satellite derived layer average (vertically) precipitable water estimates. Analysis of sea surface temperature provided valuable information on the cooling of the Arabian Sea during the summer of 1979. Integrations with simple single-level barotropic and primitive equation models with high horizontal resolution were performed to assess the predictive skill of such models over several tropical domains using the best available data sets. The results show varied skill over different domains. ESA

N87-25658# Nairobi Univ. (Kenya). Dept. of Meteorology.
THE ASIAN SUMMER MONSOON
P. K. Das *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 381-401 (For primary document see N87-25654 19-47)
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The benefits of FGGE and Monsoon Experiment (MONEX) of 1979 for short and long range prediction of the Asian summer monsoon are reviewed. Analysis of the data reveals an abrupt rise in the kinetic energy of the lower troposphere over the Arabian sea just prior to monsoon onset. The onset was linked with a build-up of moisture and intensification of lower tropospheric winds over the Arabian sea. The sea cooled between May and July. The oceanic heat loss during this period is estimated to be 80 W/sqm. Cooling mechanisms are associated with a coastal Somali current and the eastward movement of cold upwelled water. Two stable predictors for predicting the total seasonal rainfall are described. Performances of an autoregressive model and of long range integrations of general circulation models are compared. ESA

N87-25659# Malayan Meteorological Service, Singapore.
ADVANCES AND SCIENTIFIC FINDINGS IN RELATION TO MONSOONAL CIRCULATIONS RESULTING FROM WINTER MONSOON EXPERIMENT (MONEX)
Boon-Khean Cheang *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 403-427 (For primary document see N87-25654 19-47)
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The scientific problems defined for the Winter Monsoon Experiment (MONEX) are used to compare knowledge before and after the Global Weather Experiment. In planetary-scale problems, major advances are noted in the understanding of short-term mid-latitude-tropical and longitudinal interactions after a cold surge, including observations of cyclogenesis and enhanced convection in the equatorial region, feedback from equatorial convection to midlatitude circulation systems, tropical east-west circulations, and cross-equatorial influences. In regional-scale problems, the quasi-stationary Borneo disturbance convective activity is found to be very much controlled by diurnal variations of the land and sea

breezes. The prevalence of mesoscale organization of convection in this region not unlike that found in the GATE experiment is noted. ESA

N87-25660# Calabar Univ. (Nigeria). Dept. of Geography and Regional Planning.
WEST AFRICA MONSOON EXPERIMENT (WAMEX)-79: ITS SIGNIFICANT CONTRIBUTIONS TO THE UNDERSTANDING OF MONSOONAL CIRCULATIONS IN WEST AFRICA DURING THE NORTHERN SUMMER
D. O. Adefolalu *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 429-460 (For primary document see N87-25654 19-47)
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The West African Monsoon Experiment was conducted from May to August 1979 during the First GARP Global Experiment. The summer component of the global monsoonal circulation is the major concern in West Africa because 80% (and in the Sahel, 100%) of the annual rainfall is received during the northern summer. The variable nature of the summer monsoon and its relation to precipitation are described. These and other studies emphasize the dominant role of planetary scale features on the monsoonal circulation and on synoptic and subsynoptic scale weather systems. This suggests that, in West Africa, interactions at hemispheric and interhemispheric levels need to be better understood if advances in numerical prediction experiments are to benefit the subregion. ESA

N87-25661# National Weather Service, Silver Spring, Md.
OVERVIEW OF THE RESULTS OF THE GLOBAL WEATHER EXPERIMENT AND THEIR APPLICATION IN THE WORLD WEATHER WATCH
J. R. Neilon *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 463-469 (For primary document see N87-25654 19-47)
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The effects on the World Weather Watch (WWW), of the Global Weather Experiment (GWE) are discussed. The most apparent changes took place in the Global Observing System, primarily in the space-based subsystem. Innovations were also introduced during the GWE into the Global Data Processing System (GDPS) and the Global Telecommunication System (GTS). The improvements and extensions of capability offer possibility of fundamental restructuring of the GDPS and the GTS. The effect of the GWE on the support elements of the WWW are also discussed. The origins of the Integrated WWW System Study (ISS) are presented and the incorporation of the results of the GWE in the ISS is explained. The nontechnical aspects of the GWE are examined in the context of their applicability to the WWW and steps which might be taken to incorporate more fully into the WWW the experience gained during and since the GWE are suggested. ESA

N87-25662# World Meteorological Organization, Geneva (Switzerland).
OBSERVING SYSTEMS EXPERIMENTS AND OBSERVING SYSTEMS SIMULATION EXPERIMENTS
A. Gilchrist *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 471-498 (For primary document see N87-25654 19-47)
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Techniques for investigating meteorological observing system networks, including network studies, Observing System Experiments (OSEs) and Observing System Simulation Experiments are described. The OSEs provide a realistic way of studying the impact of particular observations or observation types on analyses and forecasts. The experiments within FGGE provide a rationale for a global observing system based on satellites to provide a broad delineation of the atmospheric temperature variation; radiosondes to add detail of the atmospheric vertical structure and to calibrate the satellite temperatures; surface observations, to provide a reference level for the satellite observations as well as details of atmospheric systems near the ground; and aircraft observations, particularly to give the structure of jetstreams. Further investigations are required particularly for the tropics but also to consider best mixes of observations. ESA

N87-25663# World Meteorological Organization, Geneva (Switzerland).
TOWARDS AN IMPROVED GLOBAL OBSERVING SYSTEM
T. Mohr *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 499-511 (For primary document see N87-25654 19-47)
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Observational requirements for a global observing system in mid and high latitudes, and in the tropics; and requirements for horizontal spacing and frequency of reporting from regional networks are discussed. Status of the system, and system components are described. Network design and implementation are considered. ESA

N87-25664# National Meteorological Center, Washington, D.C.
OUTSTANDING PROBLEMS AND FURTHER PROGRESS EXPECTED IN SHORT, MEDIUM AND LONG-RANGE FORECASTING AS A RESULT OF THE GLOBAL WEATHER EXPERIMENT
Fedor Mesinger *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 515-533 (For primary document see N87-25654 19-47)
Avail: NTIS MF A01; print copy available from WMO, Geneva, Switzerland

Progress in weather forecasting based on solving atmospheric governing equations is contrasted with the outlook as seen early this century by Milutin Milankovic. Systematic errors of prediction models are reviewed. Possibilities for further progress are discussed. It is pointed out that a substantial part of atmospheric mesoscale motion is forced by larger scales, and that this should call for longer ultimate predictability times than those following from error growth models in which small scale errors completely contaminate successively larger scales of the motion spectrum. Encouraging simulation results are listed. Plans for research and activities based on the results of the Global Weather Experiment are summarized. ESA

N87-25665# Hydrometeorological Centre of the USSR (Moscow).
DIAGNOSTICS, RESEARCH AND SCIENTIFIC ACHIEVEMENTS BASED ON THE FGGE OCEANOGRAPHIC PROGRAM AND APPLICATION OF OCEANIC DATA IN OPERATIONAL LONG-RANGE WEATHER FORECASTING **c48**
G. P. Kurbatkin *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 535-554 (For primary document see N87-25654 19-47)
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The scientific achievements of the FGGE oceanographic program are assessed according to the degree of complexity and importance of the programs main objectives. Results show that the tropics are the key regions for air-sea interactions. Detailed information on the surface currents of the Southern Ocean was obtained using FGGE buoy drift data. Using the results of the MONEX experiment, the development of thermodynamic ocean processes in specific years and seasons, along with their anomalies

and consequent causal links with atmospheric phenomena is described. The position of atmospheric fronts and baroclinic zones in midlatitudes, which are affected by flows of heat and humidity from the ocean surface, are closely linked to ocean thermal conditions. The impact of sea surface temperature anomalies on atmospheric dynamics may be more pronounced on eastern coasts than on western. The anomalies spread through the ocean mixing layer, with a typical amplitude of 1 K and a half-life of 3 months. ESA

N87-25666# Reading Univ. (England). Dept. of Meteorology.
THE USE OF FGGE DATA IN THE WMO PROGRAMME OF RESEARCH IN TROPICAL METEOROLOGY
R. P. Pearce *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 555-566 (For primary document see N87-25654 19-47)
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Use of FGGE data in tropical cyclone forecasting research; monsoon studies; and tropical droughts and semiarid zone meteorology is described. Two weak and two strong cyclones in the west Pacific were studied. A genesis period of strengthening tangential winds occurs, but these show different degrees of inner intensification and upper outflow patterns. Experiments on the onset of the 1979 Asian summer monsoon with the ECMWF forecast model with different parameterizations of convection are outlined. Insights into the large-scale dynamical characteristics of semiarid regions, and the role of radiation were gained. ESA

N87-25667# World Meteorological Organization, Geneva (Switzerland).
THE DEVELOPMENT AND APPLICATION OF FINE MESH MODELS
A. J. Gadd *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 567-582 (For primary document see N87-25654 19-47)
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The use of limited-area fine mesh models (LFMs) to provide a horizontal resolution greater than is possible in global models during GARP is discussed. Limitations on computing power imply a requirement for these regional models in the World Weather Watch. In extratropical forecasting the benefits are found in the prediction of the smaller synoptic scales, especially fronts, and there is a marked impact on precipitation forecasts. Comparable benefits may be expected in tropical forecasting, though problems of establishing the initial conditions with sufficient accuracy are more severe. Problems with LMF include a requirement to provide boundary updating information at the edges of the fine mesh region. Numerical techniques, physical parametrizations, and analysis and assimilation methods developed in the Global Weather Experiment are appropriate for global and for limited-area fine-mesh modeling. ESA

N87-25668# Bureau of Meteorology, Melbourne (Australia).
THE IMPACT OF THE GLOBAL WEATHER EXPERIMENT ON OPERATIONAL NUMERICAL WEATHER PREDICTION AND FORECASTING IN AUSTRALIA: IMPLICATIONS FOR THE DEVELOPMENT OF THE WORLD WEATHER WATCH PROGRAM
J. W. Zillman and W. K. Downey *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 585-602 (For primary document see N87-25654 19-47)
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The Global Weather Experiment had a major and lasting impact on numerical weather prediction and operational weather forecasting in Australia. The greatest overall positive contributions were made by the satellite systems (imagery, sounding, data collection capability and cloud track winds), numerical model developments, the Southern Ocean drifting bouy system, and ASDAR. Improvements in numerical prediction are however, relatively slow in producing improvements in weather forecasting and the impacts of the FGGE systems directly and of the improved numerical prediction capability on weather forecasting skill differ significantly between the tropical and higher latitude areas of Australia. ESA

N87-25669# Atmospheric Environment Service, Dorval (Quebec).
GLOBAL INTEGRATIONS WITH THE RPN SPECTRAL/FINITE-ELEMENT MODEL USING FGGE DATA
M. Beland *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 603-612 (For primary document see N87-25654 19-47)
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Results of integrations of a spectral/finite element model with a vertical discretization scheme, a sophisticated boundary layer, and gravity wave drag parameterization are presented. The integrations were performed with FGGE data sets. The quality of the data set allows the investigator to concentrate only on the accuracy or efficiency of the model or scheme, and it offers the opportunity to calibrate the model against others simply by scanning the literature or participating in intercomparison experiments. ESA

N87-25670# State Meteorological Inst., Beijing (China).
APPLICATION OF FGGE RESULTS IN CHINA AND THE METEOROLOGICAL EXPERIMENT IN THE TIBETAN PLATEAU IN 1979
Jibin Luo *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 613-616 (For primary document see N87-25654 19-47)
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The FGGE data was used to improve numerical weather forecasting; to study the atmospheric energy balance especially the energy budget over the Tibetan Plateau; for analysis and simulation of monsoon onset and breaks; in tests of fourth order pseudo-spectral and central finite difference schemes; for comparison of diagnostic analyses; and use of wind and geopotential height data in initialization of models. The role played by the Tibetan Plateau in the general circulation of atmosphere and its effect on the weather in China were studied. ESA

N87-25671# Direction de la Meteorologie Nationale, Paris (France).
USE OF GLOBAL WEATHER EXPERIMENT DATA SETS BY THE FRENCH NATIONAL METEOROLOGICAL SERVICE
F. Duvernet *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 617-622 (For primary document see N87-25654 19-47)
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Two series of experiments were carried out with data sets produced in the Global Weather Experiment. The first series studied the impact of radiosoundings over the North Atlantic on European short-range forecasts, using 2-b data sets. It shows a significant positive influence of the North Atlantic radiosoundings on forecasts. The results are confirmed by those of a similar experiment. The second series of experiments concerns the use of the objective analysis files based on the 3-b data sets produced in the Global Weather Experiment. It is shown how these data made it possible to validate rationally and economically an operational numerical prediction model. ESA

N87-25672# Meteorologischer Dienst der DDR, Potsdam (East Germany).
ACHIEVEMENTS BY THE METEOROLOGICAL SERVICE OF THE GERMAN DEMOCRATIC REPUBLIC IN NUMERICAL WEATHER PREDICTION (NWP) BASED ON GLOBAL WEATHER EXPERIMENT DATA AND METHODS AND SOME REMARKS ON THE DEVELOPMENT OF THE WORLD WEATHER WATCH (WWW)
J. Kluge *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 623-629 (For primary document see N87-25654 19-47)
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Long-term verification statistics of short and medium-range forecasts of standard weather elements as disseminated to users are examined as an overall indicator of the impact of national and FGGE-related efforts in weather prediction research, technology, and observational system development. Progress was made in medium range forecasts of local weather elements at daily intervals up to 6 days ahead. The range of predictability of maximum and minimum temperature, probability of precipitation, and duration of sunshine doubled. Skill of the short range statistical forecasts shows a continuous increase. The trends are closely associated with FGGE but the full impact can only be achieved with efforts at the national level to exploit the extra data available by corresponding refinement of all parts of the numerical prediction (NWP) system and synpotic methods. In order to fully use World Weather Watch data, the need for national centers to improve their overall NWP systems and to combine dynamical and statistical interpretation and numerical and synoptic methods in a balanced manner is emphasized. ESA

N87-25673# World Meteorological Organization, Geneva (Switzerland).
IMPACT OF THE GLOBAL WEATHER EXPERIMENT ON THE OPERATIONS OF THE DEUTSCHER WETTERDIENST
T. Mohr and H. Reiser *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 631-637 (For primary document see N87-25654 19-47)
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Benefits from and contributions to the global weather experiment of the West German meteorological service (DWD) are described. The DWD contributed to the observing system via its national observing network, the observations from 400 ships participating in the Voluntary Observing Fleet, a research vessel, a mobile aerological ship station AIREPs aboard civil aircraft, a prototype ASDAR unit, METEOSAT, and the deployment of buoys in the South Pacific. Two data centers were established, one for observational data from ships and one for oceanic data. Benefits accrued to numerical weather prediction; interactive handling and use of observational data for very short range forecast, monitoring of the results of numerical models, and the deduction of bogus data; and observing system components. ESA

N87-25674# Japan Meteorological Agency, Tokyo.
PROGRESS IN OPERATIONAL NUMERICAL WEATHER PREDICTION AT THE JAPAN METEOROLOGICAL AGENCY DUE TO THE RESULTS ACHIEVED DURING THE FGGE
K. Tada and A. Sumi *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 639-645 (For primary document see N87-25654 19-47)
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It is shown that the improvement of data coverage achieved during the FGGE period and subsequently greatly contributes to the increased forecast skill of the numerical models of the Japan Meteorological Agency. The impact from observations obtained from space-based platforms (polar orbiting and geostationary satellites) and aircraft data is fully apparent in daily operational numerical forecasts. It is concluded that progress in numerical methods such as optimum interpolation, nonlinear normal-mode initialization techniques, together with the developments in high resolution models have a significant effect on daily forecasts. ESA

N87-25675# World Meteorological Organization, Geneva (Switzerland).
DEVELOPMENTS IN GLOBAL FORECASTING AT BRACKNELL SINCE THE GLOBAL WEATHER EXPERIMENT
J. T. Houghton *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 647-658 (For primary document see N87-25654 19-47)
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During the FGGE a real-time global data assimilation experiment in which the FGGE observations were assimilated into a global numerical prediction model by a technique of repeated insertion was conducted. The data base of analyses thus obtained is used in research on the dynamics of the general circulation, in observing system experiments, and in monsoon simulation studies. The analysis and prediction techniques used during the FGGE were improved. A global and regional analysis/forecast system using 15 levels is in operational use with applications in many parts of the world and for several distinct user communities. The model is highly efficient in handling explosive cyclogenesis in extratropical regions. However, there are systematic errors in 3 to 5 day forecasts, with excessive westerlies in Northern Hemisphere middle latitudes, but performance improved markedly on the introduction of a parametrization of gravity-wave drag at upper levels over orography. ESA

N87-25676# National Meteorological Center, Washington, D.C.
ACHIEVEMENTS BY NMC WASHINGTON IN NWP APPLICATIONS BASED ON GLOBAL WEATHER EXPERIMENT DATA AND METHODS
William C. Bonner *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 659-670 (For primary document see N87-25654 19-47)
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The evolution of large-scale analysis and forecast systems from the early 1970's to the present is traced. Statistics are presented that show a significant increase in the skill of short and medium range guidance forecasts during this period. Much of this increase in skill is attributed to new global data sets and to the impetus provided to numerical weather prediction research by the Global Weather Experiment. Systems implemented or planned for implementation on the CYBER 205 computer promise still larger improvements in the next several years. ESA

N87-25677# Joint Publications Research Service, Arlington, Va.
CHINA REPORT: SCIENCE AND TECHNOLOGY
22 Aug. 1986 103 p Transl. into ENGLISH from various Chinese articles
(JPRS-CST-86-034) Avail: NTIS HC A06/MF A01

Topics addressed include: life sciences; applied sciences; physical sciences; national developments; and abstracts from chemical engineering, computer science, electronics, metallurgy, and nuclear energy. For individual titles, see N87-25678 through N87-25679.

N87-25678# Joint Publications Research Service, Arlington, Va.
MATHEMATICAL MODELS OF WIND, DIVERGENCE FIELDS OF TYPHOON PROPOSED
Shuyao Yuan and Jiajun Xu *In its* China Report: Science and Technology 22 Aug. 1986 p 24-36 Transl. into ENGLISH

from Nanhai Haiyang Kexue Jikan (Beijing, China), no. 3, Jul. 1982 p 81-90 (For primary document see N87-25677 19-47)
Avail: NTIS HC A06/MF A01

The catastrophes brought about by the destructive waves caused by the torrential rains and gusty winds of a typhoon are all too familiar to the meteorologists. Under the current situation of lacking direct observation data at sea level, understanding the wind field structure of the typhoon will have significant implications in the forecast of strong winds and waves as well as the further study of the weather patterns of the typhoon. Such are the objectives, in which preliminary studies of the problems associated with the distribution of wind and divergence fields were carried out and mathematical models of typhoon wind and divergence fields at the sea level were established. Author

N87-25679# Joint Publications Research Service, Arlington, Va.
SEA-AIR HEAT EXCHANGE NEAR XISHA ISLANDS STUDIED
Tegu Chen *In its* China Report: Science and Technology 22 Aug. 1986 p 37-44 Transl. into ENGLISH from Nanhai Haiyang Kexue Jikan (Beijing, China), no. 3, Jul. 1982 p 91-97 (For primary document see N87-25677 19-47)
Avail: NTIS HC A06/MF A01

There exists a continuous heat-exchange process at the sea-air interface. Studying its rule of changes will help in understanding the temperature changes of sea water, figure out the cold and warm advections of the ocean, and unravel the relationship between the sea and the air. For the South China Sea, little was done in this area. Calculations were made based on marine observations made by merchant vessels. Because different data and approaches were used, the calculation results are quite different. The formulas used were modified and improves to calculate the monthly averages of the overall sea-air heat exchange and its components in the waters around the Xisha Islands. Preliminary analysis was made of the basic features of overall heat exchange and its correlation with sea temperature. Thus information was provided for carrying out the study of oceanic thermal structure of the waters of this region and the prediction of water temperature. Author

N87-25680# Air Command and Staff Coll., Maxwell AFB, Ala.
WEATHER WATCH: MAKING STRAIGHT THE WAY FOR AIR TRAVEL OVER THE NORTH ATLANTIC
Donald S. Dorr Apr. 1987 52 p
(AD-A179938; ACSC-87-1780) Avail: NTIS HC A04/MF A01 CSCL 04B

One of the major unsung accomplishments of the Second World War was the creation and operation of the remote weather stations in the Artic. This study traces the growth of the Army's Weather Service and the development of the weather stations which were organized to support the efforts of the North Atlantic Ferry Routes. The study describes the Weather Service's expansion, the many problems encountered in both establishing and operating these North Atlantic stations, as well as some of the evolutionary changes which occurred during the war years. GRA

N87-25681# Mission Research Corp., Albuquerque, N. Mex.
A 1985 NATURAL LIGHTNING STUDY Final Report, 2 May - 4 Nov. 1985
A. H. Paxton, L. Baker, and R. L. Gardner Dec. 1986 65 p
(Contract F29601-85-C-0009)
(AD-A180099; AMRC-R-760; MBES-2-MRC-041; AFWL-TN-86-23)
Avail: NTIS HC A04/MF A01 CSCL 04A

The principal results of MRC's lightning research during 1985, including the collaborations with the Langmuir Laboratory of the New Mexico Institute of Mining and Technology and the Air Force Weapons Laboratory, Kirtland Air Force Base, are described. Lightning strikes at the Kiva Facility of the Langmuir Laboratory have been observed and analyzed. The optical emissions and radiated electromagnetic field have been compared with computer simulations. The agreement is generally good. This facility is unique in the world, providing simultaneous measurements of stroke current, brightness, and radiated fields. The major discovery has been that the initial return stroke velocity is approximately 0.9 c as opposed to average stroke velocities reported to be about 0.3 c. GRA

N87-25682# Pacific Northwest Labs., Richland, Wash.
USER'S MANUAL FOR THE CLOUD AND SCAVENGING MODULE VERSION 1.2
B. C. Scott Apr. 1987 140 p
(Contract DE-AC06-76RL-01830)
(DE87-008344; PNL-6192) Avail: NTIS HC A07/MF A01

This report presents a detailed description of a stable cloud model. This model was designed to characterize a steady-state scavenging environment using meteorological conditions provided by a regional scale meteorology code. The model described in this report explicitly simulates processes related to cloud microphysics. The cloud model predicts the vertical profiles of condensed water that correspond to specified surface precipitation rates, surface temperatures, and cloud top heights. The cloud model also predicts profiles of various micro-physical constituents, such as fall velocity, accretion rates, etc., that exist in conjunction with the condensed water profiles. Descriptions are presented of routines written to solve mass conservation equations for air, cloud, and precipitation water. The solutions are appropriate for precipitating or nonprecipitating clouds within a mesoscale grid with horizontal spacing on the order of 50 km. Routines are also provided for generating tables of profiles for many discrete input conditions. Once tables are generated, additional routines may be used to interpolate between the tables and to rapidly provide values different from the discrete input levels. DOE

N87-25683# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
UPDATED (AS OF 28 JULY 1987) FORECAST OF ATLANTIC SEASONAL HURRICANE ACTIVITY FOR 1987
William M. Gray 1987 32 p
Avail: NTIS HC A03/MF A01

The author's updated forecast of the amount of seasonal hurricane and tropical storm activity which can be expected to occur in the Atlantic basin, Caribbean, and Gulf of Mexico region in 1987 is discussed. This updated forecast is issued just before the start of the most active part of the hurricane season. The author's previous forecast for 1987 was issued on 27 May and called for 5 hurricanes (1 below the average of the 1947 to 1986 seasons), 8 named tropical storms (2 below average), and 20 hurricane days (5 below average). This updated forecast is based on the author's earlier forecast and more recent June and July meteorological data. This revised forecast is considered to be more reliable than the forecast issued at the end of May. Statistical information received by the author as of 28 July indicates that the hurricane and tropical storm activity for 1987 can be expected to be a somewhat more suppressed than that anticipated in late May. This revised forecast indicates a probability for 4 hurricanes (2 below average), 7 hurricanes and tropical storms (3 below average), and 15 hurricane days (10 below average). Author

N87-25684*# Missouri Univ., Columbia. Dept. of Atmospheric Science.
A STUDY OF THE ADEQUACY OF QUASI-GEOSTROPHIC DYNAMICS FOR MODELING THE EFFECT OF FRONTAL CYCLONES ON THE LARGER SCALE FLOW Final Report, Jan. 1984 - Feb. 1987
Stephen Mudrick Jul. 1987 43 p
(Grant NAG5-381)
(NASA-CR-181132; NAS 1.26:181132) Avail: NTIS HC A03/MF A01 CSCL 04B

The evolution of individual cyclone waves is studied in order to see how well quasi-geostrophic (QG) dynamics can simulate the behavior of primitive equations (PE) dynamics. This work is an extension of a similar study (Mudrick, 1982); emphasis is placed here on adding a frontal zone and other more diverse features to the basic states used. In addition, sets of PE integrations, with and without friction, are used to study the formation of surface occluded fronts within the evolving cyclones. Results of the study are summarized at the beginning of the report. Author

N87-25685*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NUMERICAL STUDIES OF FRONTAL DYNAMICS Final Report, 1 Nov. 1983 - 30 Nov. 1986
Daniel Keyser 31 Dec. 1986 13 p
(Grants AF-AFOSR-ISSA-84-0012; AF-AFOSR-ISSA-85-0077)
(NASA-TM-89352; NAS 1.15:89352; AD-A180509; AFOSR-87-0685TR) Avail: NTIS HC A02/MF A01 CSCL 04A

Efforts concentrated on the development of a two dimensional primitive equation (PE) model of frontogenesis that simultaneously incorporates the frontagenetical mechanisms of confluence and horizontal shear. Applying this model to study the effects of upper level frontogenesis, it appeared to be dominated by tilting effects associated with cross front variation of vertical motion, in which subsidence is maximized within and to the warm side of the frontal zone. Results suggest that aspects characteristic of three-dimensional baroclinic waves may be abstracted to a significant extent in a two dimensional framework. They also show that upper-level frontogenesis and tropopause folding can occur in the absence of three-dimensional curvature effects, commonly believed to be necessary for realistic upper-level frontogenesis. An implication of the dominant tilting effects is that they may have to be adequately resolved by numerical weather prediction models, thus requiring better horizontal and vertical resolution. GRA

N87-25686*# Chicago Univ., Ill. Satellite and Mesometeorology Research Project.
US TORNADOES. PART 1: 70-YEAR STATISTICS
T. T. Fujita 1987 131 p Sponsored in part by NSF
(Grants NGR-14-001-008; NA85AA-DRA-064)
(NASA-CR-181140; NAS 1.26:181140; PB87-127742; SMRP-RP-218; LC-86-51637) Copyright Avail: NTIS HC A07/MF A01 CSCL 04B

If tornadoes were counted as the Gross National Product, no other country on the surface of the earth could come even close to the United States. During the recent 70 year period, the United States produced 31,054 tornadoes which left behind a cumulative path of 132,005 miles (212,396 km) which would circle the world 5.3 times along the equator. In completing the book, staff members of the Satellite and Mesometeorlogy Research Project (1961 to the present) played an important role in collecting, evaluating, and archiving the historical tornado data. GRA

N87-25687# Wyoming Univ., Laramie. Dept. of Atmospheric Science.
CLIMATOLOGY OF THE SIERRA NEVADA BARRIER JET M.S. Thesis
S. W. Smutz Aug. 1986 120 p
(Contract DI-2-07-81-V0256)
(PB87-171146; AS-153) Avail: NTIS HC A06/MF A01 CSCL 04B

The Sierra Nevada barrier jet is a mountain-parallel low level jet that is frequently observed in the foothills region of the Sierra Nevada. Serial rawinsondes have been obtained near the base of the Sierra barrier, at Sheridan, California, by the Sierra Cooperative Pilot Project since 1977. The rawinsondes were launched during storm episodes that occurred near the barrier. More than 1800 of these soundings are utilized to compile statistical characteristics of the barrier jet, examine the effects of the melting layer on the speed and height of the barrier jet, and examine the dependence of barrier jet strength on thermodynamic stability of the subcrest airmass. The stability relationship is compared to previous numerical model results. GRA

N87-25688# National Oceanic and Atmospheric Administration, Miami, Fla. Oceanographic and Meteorological Labs.
REDUCTION OF ERRORS IN OMEGA DROPWINDSONDE DATA THROUGH POSTPROCESSING
J. L. Franklin Mar. 1987 28 p
(PB87-173308; NOAA-TM-ERL-AOML-65) Avail: NTIS HC A03/MF A01 CSCL 04B

The postprocessing of Omega dropwindsonde (ODW) data at the NOAA Hurricane Research Division (HRD) is described. The errors common to ODW data are illustrated with examples, and the improvements to ODW data accuracy through postprocessing are estimated. GRA

N87-25689# National Weather Service, Garden City, N.Y.
MESOSCALE FORECASTING TOPICS
H. M. Stone Mar. 1987 24 p
(PB87-180246; NOAA-TM-NWS-ER-72) Avail: NTIS HC A02/MF A01 CSCL 04B

There are no mesoscale experts -- only good meteorologists, intent on improving their understanding of the atmosphere, and those content to blindly follow guidance. The publication is an attempt to organize knowledge about the mesoscale and permit it to be periodically updated. The authors suggest that this Technical Memo be unstapled and placed in a loose leaf binder. Past and future Technical Attachments, copies of articles, etc., would be filed under the major heading to which they pertain. GRA

N87-25690# Electronic Techniques, Inc., Fort Collins, Colo.
SCPP (SIERRA COOPERATIVE PILOT PROJECT) METEOROLOGICAL AND STATISTICAL SUPPORT FOR PERIOD 1 SEPTEMBER 1985 THROUGH 31 AUGUST 1986, VOLUME 1 Interim Progress Report
A. W. Huggins, R. M. Rauber, T. F. Lee, A. P. Kuciauskas, and G. L. Hemmer Sep. 1986 425 p
(Contract DI-4-CR-81-03860)
(PB87-171153) Avail: NTIS HC A18/MF A01 CSCL 04B

The operational and scientific contributions by Electronic Techniques, Inc. (ETI) to the Sierra Cooperative Pilot Project (SCPP) are documented. Operational methods and data collection procedures are briefly described. The first scientific articles describe the status of the SCPP targeting model, present targeting results from past seeding cases and describe important changes to be made to the model. The next articles discuss three case studies involving airborne seeding designed to impact a fixed target. The cases describe the synoptic, meso, and microscale structure of the storms with emphasis on the natural cloud evolution and the effects of seeding. GRA

N87-25691# Electronic Techniques, Inc., Fort Collins, Colo.
SCPP (SIERRA COOPERATIVE PILOT PROJECT) METEOROLOGICAL AND STATISTICAL SUPPORT FOR PERIOD 1 SEPTEMBER 1985 THROUGH 31 AUGUST 1986, VOLUME 2 Interim Progress Report
G. L. Hemmer, A. W. Huggins, R. M. Rauber, T. F. Lee, and A. P. Kuciauskas Sep. 1986 91 p
(Contract DI-4-CR-81-03860)
(PB87-171161) Avail: NTIS HC A05/MF A01 CSCL 04B

The operational and scientific contributions by Electronic Techniques, Inc. (ETI) to the Sierra Cooperative Pilot Program (SCPP) are documented. Operational methods and data collection procedures are briefly described. The first scientific articles describe the status of the SCPP targeting model, present targeting results from past seeding cases, and describe important changes to be made to the model. The next articles discuss three case studies involving airborne seeding design to impact a fixed target. The cases describe the synoptic, meso, and microscale structure of the storms with emphasis on the natural cloud evolution and the effects of seeding. A model for the evolution of large cloud droplets is presented in one of these cases. A subsequent article deals with climatological investigations of a variety of meteorological parameters and shows how the seasonal or diurnal distributions of these parameters effect seeding opportunity. GRA

N87-25692*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HEAT BUDGET OBSERVATIONS FOR THE FIRE/SRB WISCONSIN EXPERIMENT REGION FROM OCTOBER 9 THROUGH NOVEMBER 2, 1986
Charles H. Whitlock and Stuart R. LeCroy (PRC Kentron, Inc., Hampton, Va.) Jul. 1987 36 p

(NASA-TM-89159; NAS 1.15:89159) Avail: NTIS HC A03/MF A01 CSCL 04B

A map and concise tables are presented which show locations, pixel size, and heat budget products from the NOAA-9 satellite for the FIRE/SRB Wisconsin experiment region during the period 9 October through 2 November 1986. In addition to the operational standard products, a narrowband albedo parameter is calculated and presented based on values from AVHRR band 1. This parameter is useful in identifying and/or quantifying clouds on a global basis using a polar-stereographic grid system. Author

N87-25693# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.

OBSTACLE DRAG AND UPSTREAM MOTIONS IN STRATIFIED FLOW

I. P. Castro (Surrey Univ., Guildford, England) and W. H. Snyder Mar. 1987 20 p

(PB87-167748; EPA-600/D-87-054) Avail: NTIS HC A02/MF A01 CSCL 04B

Direct measurements of the drag of two- and three- dimensional obstacles in linearly stratified fluid are compared with the implications of inviscid, unsteady theory and with the few similiar measurements already available in the literature. Attention is concentrated on obstacles that generate separate wakes, and it is shown that prior to stationary lee waves, the stratification always leads to a drag reduction whose magnitude increases with the spanwise width of the obstacle. Once the stratification increases to the point where a stationary lee wave exists, the drag rises again, but usually falls thereafter whenever an integral value of the parameter, K, is approached. GRA

N87-25694# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.

HURRICANE RESEARCH DIVISION FISCAL YEAR 1986 PROGRAMS: FISCAL YEAR 1987 PROJECTIONS

Jan. 1987 53 p

(PB87-173902) Avail: NTIS HC A04/MF A01 CSCL 04B

The Hurricane Research Division (HRD) is NOAA's primary focus for research on hurricanes and tropical meteorology. HRD's research is directed at improved hurricane prediction through a detailed understanding of the structure and dynamics of these storms. HRD uses the NOAA/OAO WP-3D research aircraft to acquire data sets that are analyzed to obtain a better understanding of the dynamics and energetics of the hurricane's inner core. Observational studies of the hurricane's synoptic environment are conducted. Theoretical and numerical modeling studies of hurricanes are also included in HRD's program. GRA

N87-25695# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.

COMPARISON OF RESULTS FROM TWO TRAJECTORY MODELS USED TO PRODUCE FLOW CLIMATOLOGIES TO THE WESTERN MEDITERRANEAN

J. M. Miller, D. Martin, and B. Strauss Jan. 1987 17 p

(PB87-176418; NOAA-TM-ERL-ARL-151) Avail: NTIS HC A02/MF A01 CSCL 04B

Two trajectory models, the Air Resources Laboratory gridded model and the geopotential model from the Direction de al Meteorologie Nationale, France, were used to characterize the flow climatology to a point in the Western Mediterranean. A long term climatology was established on the basis of similar typing schemes. The results show that the two models, though quite different in their approaches, describe the flow patterns very closely. GRA

N87-25696# National Weather Service, Fort Worth, Tex.

OBSERVED MICROBURSTS IN THE NWS (NATIONAL WEATHER SERVICE) SOUTHERN REGION DURING 1986: FOUR CASE STUDIES

C. J. Sohl, W. L. Read, M. L. Branick, and J. C. Lowery Apr. 1987 56 p

(PB87-180204; NOAA-TM-NWS-SR-121) Avail: NTIS HC A04/MF A01 CSCL 04B

Topics addressed include: West Texas dry microbursts of 21 May 1986; forecasting potential severe downburst days in north Texas; report on the Mustang downburst of 26 July 1986; and Memphis microburst of 18 July 1986. GRA

N87-25697# National Severe Storms Lab., Norman, Okla.

NATIONAL SEVERE STORMS LABORATORY , FISCAL YEAR 1986 Annual Report, 1 Oct. 1985 - 30 Sep. 1986

Jan. 1987 45 p

(PB87-180428) Avail: NTIS HC A03/MF A01 CSCL 04B

Topics addressed include: meteorological research; doppler radar and storm electricity research; computer and engineering support and development; and cooperative institure for mesoscale meteorological studies. GRA

N87-25698# National Severe Storms Lab., Norman, Okla.

SPRING PROGRAM SUMMARY, 1986 (NATIONAL SEVERE STORMS LABORATORY)

D. J. Stensrud and D. W. Burgess Feb. 1987 65 p

(PB87-180436; NOAA-TM-ERL-NSSL-100) Avail: NTIS HC A04/MF A01 CSCL 04B

The National Severe Storms Laboratory (NSSL) conducts scientific research, technology development programs, and operational implementation activities designed to improve understanding and predictions of middle latitude severe weather phenomena, and to improve remote sensors for research support and operational detection and warning of all types of severe weather. Principal objectives of the 1986 Spring Program were to: enhance the data base of the Storm Electricity Group engages in determining lightning effects on precipitation, lightning characteristics, and the relationships between the various storm electrical phenomena and the observable storm parameters; obtain a dual Doppler data set from a tornadic storm; acquire single Doppler data from several squall lines, along with radiosonde data prior to squal line passage; transfer real-time Doppler data to Oklahoma City NWSFO to aid in severe weather detection and warnings, and familiarize the NWS forecasters with interpreting the Doppler displays; and collect Doppler data on microbursts to determining precursors of the phenomenon as well as the asymmetry of the low altitude outflow. GRA

N87-25699# National Weather Service, Salt Lake City, Utah.

PRELIMINARY LIGHTNING CLIMATOLOGY STUDIES FOR IDAHO

C. D. Hill, C. J. Gorski, and M. C. Conger Apr. 1987 49 p

(PB87-180196; NOAA-TM-NWS-WR-198) Avail: NTIS HC A03/MF A01 CSCL 04B

Two years of cloud-to-ground lightning strike data are used to develop a preliminary thunderstorm climatology for Idaho. Preliminary results suggest earlier climatologies based on widely separated weather observing stations which underestimate the number of thunderstorm days in the region. Variations in the frequency of lightning under differing mid-tropospheric flow patterns are investigated. GRA

N87-25700# Washington Univ., Seattle. Dept. of Atmospheric Sciences.

STUDIES OF THE MECHANISMS AND RATES WITH WHICH NITROGEN SPECIES ARE INCORPORATED INTO CLOUD WATER AND PRECIPITATION Annual Report no. 2

D. A. Hegg and P. V. Hobbs Oct. 1986 44 p Sponsored by Coordinating Research Council, Inc., Atlanta, Ga.

(PB87-180360; CRC-APRAC-CAPA-21-80-05) Avail: NTIS HC A03/MF A01 CSCL 04B

Work conducted during the second year on the interactions of nitrogen species with clouds is summarized. Research during the second year centered on resolution of several important issues. First, airborne cloud water collectors currently in use by the research community are poorly characterized with regard to collection efficiency and the effects of collection on the chemical composition. Both points were addressed with respect to the two cloud water samplers that Washington is using. No evidence for chemical modification of samples by the collection process was

found. Secondly, analysis of the mass ratio of cloud water nitrate to sulfate in marine and continental clouds confirms that this ratio is a good indicator of the degree to which clouds are continentalized. Finally, preliminary analysis of data acquired with the airborne sampling system were analyzed for evidence of nitrate production in the clouds. As part of the research, instrumentation for the detection of low levels of HNO3, NO2, and PAN was flown and tested on the Washington aircraft. GRA

N87-25701*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONITORING AND PREDICTING TROPICAL CYCLONE MOVEMENT USING GEOSYNCHRONOUS SATELLITE REMOTE SENSING TECHNIQUES
L. Dubach, ed. and R. Cecil Gentry (Clemson Univ., S.C.) Apr. 1986 39 p
(NASA-TM-87797; NAS 1.15:87797) Avail: NTIS HC A03/MF A01 CSCL 04B

Data collected on special hurricane days by the VISSR Atmospheric Sounder (VAS) instrument flown on a satellite in 1981 and 1982 were studied for their usefulness in forecasting motion of hurricanes. The retrieved constant pressure heights for the 500-mb surface provided the basis for reasonable forecasts of 24 hour hurricane motion. The conclusions are illustrated with examples from Hurricane Harvey (1981) and Hurricane Irene (1981). Recommendations are made for future use of the VAS type instruments for tropical cyclone forecasting. Author

N87-25268*# Federal Aviation Administration, Washington, D.C.
CASE HISTORY OF FAA/SRI WIND SHEAR MODELS
Herbert Schlickenmaier *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 3-10 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

N87-25269*# Federal Aviation Administration, Washington, D.C. Office of Flight Operations.
HISTORY OF WIND SHEAR TURBULENCE MODELS
Lou Cusimano *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 11-12 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

N87-25270*# National Center for Atmospheric Research, Boulder, Colo. JAWS Project.
INTRODUCTION TO THE JAWS PROGRAM
John McCarthy *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 13-27 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

N87-25271*# National Center for Atmospheric Research, Boulder, Colo. Joint Airport Weather Studies Project.
JAWS MULTIPLE DOPPLER DERIVED WINDS
Kimberly L. Elmore *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 29-42 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

N87-25272*# National Center for Atmospheric Research, Boulder, Colo. JAWS Project.
STATUS OF THE JAWS PROGRAM
John McCarthy *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 43-47 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

N87-25274*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND SHEAR AND TURBULENCE SIMULATION
Roland L. Bowles *In its* Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 67-95 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

N87-25277*# FWG Associates, Inc., Tullahoma, Tenn.
TURBULENCE MODELS
Walter Frost *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 125-151 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N87-25702# Rhode Island Univ., Kingston. School of Oceanography.
DEEP-OCEAN BOTTOM PRESSURE AND TEMPERATURE SENSORS REPORT: METHODS AND DATA Summary Report, Sep. 1983 - May 1985
D. R. Watts and H. Kontoyiannis Dec. 1986 119 p
(Contract N00014-81-C-0062; Grant NSF OCE-82-01222)
(AD-A179911; URI/GSO-TR-86-8) Avail: NTIS HC A06/MF A01 CSCL 08C

This report documents ocean bottom pressure data collected in 11 deployments of pressure sensors under the Gulf stream northeast of Cape Hatteras in depths of 3300 to 3900 m. In past experiments pressure sensors suitable for ocean depths have typically exhibited systematic drifts in calibration that seriously contaminate any observed periodicities longer than a few days. We used Digiquartz sensors because they offered potentially much lower drift than other commercially available sensors. In these sensors, either a bellows or a Bourdon tube applies stress to an oscillating quartz-crystal beam, causing its oscillation frequency to vary. Several factors influence the amount of drifts: bellow vs. Bourdon-tube construction; applied pressure; duration of deployment; and, for some sensors, high-pressure preconditioning in the lab. For the sensors deployed in the Gulf Stream, the total drift during deployments lasting from 3 to 12 months ranged from undetectable (0.01 dbar) to 0.20 to 0.50 dbar. About half of the total drift typically occurred within the first 6 days of deployment. We estimate the residual error in the final pressure records, after the dedrifting calculations, to be typically 0.02 dbar rms (or 0.06 dbar rms) if the first 6 days of the record are excluded (or included, respectively). This low drift error opens many possibilities for studies that require knowledge of the low-frequency dynamic pressure signal in the deep ocean. GRA

N87-25703# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
OCEAN REMOTE SENSING WITH DIFFERENTIAL ABSORPTION SONAR
J. H. Churnside Dec. 1986 25 p
(PB87-165015; NOAA-TM-ERL-WPL-144) Avail: NTIS HC A02/MF A01 CSCL 08C

A measurement of the relative absorption of sound at two closely spaced frequencies and a simultaneous measurement of sound speed can provide a remote measurement of temperature and salinity or of temperature and pH. The former pair of parameters results when frequencies above a few kilohertz are used and the latter pair from lower frequencies. With careful model calibration, measurement accuracy depends only on signal-to-noise ratio. Values of temperature to within about 0.1 C and salinity to about

0.1 ppt should be possible if 40 dB of signal-to-noise can be obtained. Author (GRA)

N87-25704# Colorado School of Mines, Golden. Center for Wave Phenomena.
SELECTED RESEARCH PROGRAM OF THE OFFICE OF NAVAL RESEARCH Final Report, 1-31 Jan. 1987
Norman Bleistein, Jack K. Cohen, John A. DeSanto, and Frank G. Hagim 31 Jan. 1987 95 p
(Contract N00014-84-K-0049)
(AD-A180264; CWP-058) Avail: NTIS HC A05/MF A01 CSCL 12A

This is the final report for the project, The Application of Inverse Methods to the Ocean Environment, supported by the Selected Opportunities Research Program of the Office of Naval Research at the Colorado School of Mines. During the three years spanned by the SRO, major progress has been made in the theory and application of inversion methods. At the start of the SRO, our inversion techniques were restricted to idealized data and physical assumptions. At the conclusion of the SRO, the theory and techniques had been extended to encompass most of the standard data collection procedures and were based on much more realistic physical assumptions. Research efforts have been reported in technical reports, journal articles and proceedings and have been presented at national and international meetings including invited talks and invited articles. The SRO program at the Colorado School of Mines consisted of two major projects in inverse scattering. The first of these is reflector imaging for seabed mapping and seismic exploration. The second is ocean profile inversion. The progress achieved in both projects under the support of this contract is described. Work continues. GRA

N87-25665# Hydrometeorological Centre of the USSR (Moscow).
DIAGNOSTICS, RESEARCH AND SCIENTIFIC ACHIEVEMENTS BASED ON THE FGGE OCEANOGRAPHIC PROGRAM AND APPLICATION OF OCEANIC DATA IN OPERATIONAL LONG-RANGE WEATHER FORECASTING
G. P. Kurbatkin *In* WMO Proceedings of the International Conference on the Results of the Global Weather Experiment and their Implications for the World Weather Watch, Volume 2 Apr. 1986 p 535-554 (For primary document see N87-25654 19-47)
Copyright Avail: NTIS MF A01; print copy available from WMO, Geneva, Switzerland

51 LIFE SCIENCES (GENERAL)

N87-25705*# Tuskegee Inst., Ala. Dept. of Biology.
MORPHOMETRICS OF CELLULAR DAMAGE IN MICE TESTIS RECEIVING X-RAY AND HIGH-ENERGY PARTICLE IRRADIATION Final Technical Report
Walter J. Sapp Jun. 1987 27 p
(Contract NCC2-12)
(NASA-CR-180994; NAS 1.26:180994) Avail: NTIS HC A03/MF A01 CSCL 06B

Murine tests were exposed to single, low doses of either X-ray, helium, or argon radiation. Animals were sacrificed seventy-two hours later. Testes were fixed for transmission electron microscopy (TEM) and sectioned at either 60 nm for TEM observation or at 2 micron for counting using routine light microscope methods. Counts of the total population of surviving spermatogonia, including all type A cells, intermediate, and type B cells, were taken from tubule cross sections identified as Stage 6 and Stage 1 according to spermatogonial configuration. The surviving fraction of spermatogonia as compared to control, S/S sub o, was calculated for each dose. For both ions and X-rays, there was a rapid decline in survival at dose levels of .10 to .15 Gy in Stage 6 tubules. This was followed by a more gradual decrease in population. At higher doses, 0.30 Gy for argon and 0.80 Gy for helium and X-rays, the cell survival rates declined rapidly. Pre-leptotene spermatocytes in Stage 1 tubules exhibited a different survival curve indicating the extreme radio-sensitivity of type B spermatogonia. Data verify that the seminiferous tubules are composed of a heterogeneous population of cells with different radio-sensitivities and that these differences are manifested even at very low doses. Author

N87-25706# Harvard Univ., Cambridge, Mass.
UNRAVELING PHOTOSYSTEMS
L. Bogorad 1986 47 p
(Contract DE-AC02-82ER-12085)
(DE87-009258; DOE/ER-12085/T1) Avail: NTIS HC A03/MF A01

A central problem in photosynthesis is to identify the proteins of the energy transducing membranes and to understand their physical and functional relationships to one another. In the course of sequencing stretches of chloroplast DNA of various plants, ORFs (open reading frames) for unidentified proteins have been found. Through the use of antibodies against synthetic peptides that correspond to amino acid sequences in some of these UORFs (unidentified ORFs), that one such open reading frame codes for a component of PSII (photosystem II), that the product of another is associated with thylakoid membranes but can be found in both PSI and PSII particles, and that a third, from preliminary experiments, appears to be probably associated with PSII. None of these had been known to be components of the photosynthetic apparatus before. DOE

N87-25707*# Houston Univ., Tex. Dept. of Biology.
GROWTH OF PLANT TISSUE CULTURES IN SIMULATED LUNAR SOIL: IMPLICATIONS FOR A LUNAR BASE CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM (CELSS) Semiannual Status Report, 1 Feb. - 31 Jul. 1987
S. Venketeswaran Aug. 1987 45 p
(Grant NAG9-214)
(NASA-CR-181131; NAS 1.26:181131) Avail: NTIS HC A03/MF A01 CSCL 06B

Experiments to determine whether plant tissue cultures can be grown in the presence of simulated lunar soil (SLS) and the effect of simulated lunar soil on the growth and morphogenesis of such cultures, as well as the effect upon the germination of seeds and the development of seedlings were carried out . Preliminary results on seed germination and seedling growth of rice and calli growth of winged bean and soybean indicate that there is no toxicity or inhibition caused by SLS. SLS can be used as a support medium with supplements of certain major and micro elements. Author

N87-25708*# Louisville Univ., Ky. Dept. of Microbiology and Immunology.
DEVELOPMENT AND TESTING OF A MOUSE SIMULATED SPACE FLIGHT MODEL Final Report, Nov. 1982 - Jul. 1987
Gerald Sonnenfeld 7 Aug. 1987 11 p
(Contract NCC2-213)
(NASA-CR-181155; NAS 1.26:181155) Avail: NTIS HC A02/MF A01 CSCL 06B

The development and testing of a mouse model for simulating some aspects of weightlessness that occurs during space flight, and the carrying out of immunological experiments on animals undergoing space flight is examined. The mouse model developed was an antiorthostatic, hypokinetic, hypodynamic suspension model similar to one used with rats. The study was divided into two parts. The first involved determination of which immunological parameters should be observed on animals flown during space flight or studied in the suspension model. The second involved suspending mice and determining which of those immunological parameters were altered by the suspension. Rats that were actually flown in Space Shuttle SL-3 were used to test the hypotheses. Author

N87-25715# Cologne Univ. (West Germany). Neurobiologische Forschung.
PHARMACOLOGICAL APPROACHES TO PERFORMANCE ENHANCEMENT IN ANIMALS
D. G. Spencer, Jr., T. Schuurman, U. Benz, E. Horvath, and J. Traber *In* AGARD Biochemical Enhancement of Performance Mar. 1987 11 p (For primary document see N87-25709 19-52)
Copyright Avail: NTIS HC A07/MF A01

N87-25743# Joint Publications Research Service, Arlington, Va.
FLUID AND ELECTROLYTE CONTENT IN PREGNANT RATS AND THEIR OFFSPRING FOLLOWING FLIGHT ABOARD COSMOS-1514 BIOSATELLITE
Ye. I. Shakhmatova, Ye. A. Lavrova, Yu. V. Natochin, L. V. Serova, and L. A. Denisova *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 56-63 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 42-47 (For primary document see N87-25734 19-52)
Copyright Avail: NTIS HC A08/MF A01

N87-25744# Joint Publications Research Service, Arlington, Va.
EFFECT OF DIPHOSPHONATES ON DEVELOPMENT OF OSTEOPOROSIS IN HYPOKINETIC RATS
A. S. Kaplanskiy, G. N. Durnova, Z. F. Sakharova, and B. V. Morukov *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 64-68 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), vol. 21, no. 1, Jan. - Feb. 1987 p 47-51 (For primary document see N87-25734 19-52)
Copyright Avail: NTIS HC A08/MF A01

N87-25745# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF INCIDENCE OF MORPHOLOGICAL CHANGES IN RAT CEREBRAL CORTEX NEURONS UNDER THE EFFECT OF ACCELERATED CARBON IONS
B. S. Fedorenko, R. A. Kabitsyna, G. N. Krivitskaya, V. I. Derevyagin, and N. I. Ruzhov *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 69-74 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 51-55 (For primary document see N87-25734 19-52)
Copyright Avail: NTIS HC A08/MF A01

N87-25747# Joint Publications Research Service, Arlington, Va.
CENTRAL HEMODYNAMICS OF MONKEYS IN POSTOPERATIVE PERIOD AS RELATED TO HANDLING PRIOR TO SURGICAL INTERVENTION
R. T. Kazakova, V. P. Krotov, and I. O. Giryayeva *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 81-84 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 58-60 (For primary document see N87-25734 19-52)
Copyright Avail: NTIS HC A08/MF A01

N87-25896*# Texas Univ., Austin. Dept. of Occupational Health.
EVALUATION OF AN AUTOMATED KARYOTYPING SYSTEM FOR CHROMOSOME ABERRATION ANALYSIS
Howard M. Prichard *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 10 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 10 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 06B

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N87-25709# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.
BIOCHEMICAL ENHANCEMENT OF PERFORMANCE
Mar. 1987 132 p In ENGLISH and FRENCH Symposium held in Lisbon, Portugal, 30 Sep. - 2 Oct. 1986
(AGARD-CP-415; ISBN-92-835-0414-3) Copyright Avail: NTIS HC A07/MF A01

In modern weapons systems, the operator is in an environment of high information flux. His ability to receive, process, and act on the information is finite and therefore full system effectiveness may never be achieved because of operator limitations. Major advances are being made in areas dealing with regulation of neuronal responsiveness. This offers a number of opportunities for exploring ways in which the biochemistry of neurons may be altered, reversibly, to increase responsiveness to neurotransmitters and/or other agents. Human performance may be enhanced through these alterations. The agents which initiate the change in neuron responsiveness may be supplied through nutrition, pharmaceuticals, or biochemicals. The use of pharmaceutical to promote sleep, increase vigilance, and to alter regulatory centers is considered. Neurotransmitter precursors were supplied via nutritional supplements. For individual titles, see N87-25710 through N87-25722.

N87-25710# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
ENHANCEMENT OF PERFORMANCE: OPERATIONAL CONSIDERATIONS
A. N. Nicholson *In* AGARD Biochemical Enhancement of Performance Mar. 1987 6 p (For primary document see N87-25709 19-52)
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Maintaining the effectiveness of aircrew during intensive and sustained operations requires knowledge from many disciplines. The first is that of understanding how the performance of individuals is modified by unusual patterns of work and rest, and how deterioration in performance can be limited by the use of short periods of sleep. The second is a detailed understanding of drugs and how they can be used either to preserve sleep or to maintain viligance. The initial approach, if this is possible, must be to optimize the work pattern, but the pattern of rest can always be optimized. The most effective approach at present is likely to be the use of short periods of sleep, probably before rather than during duty periods, and to ensure restful sleep between operations by the use of hypnotics. At present the role of hypnotics is much less certain. Caffeine is used widely and is clearly effective. Drugs which modify monoaminergic transmission require a much greater understanding, both their pharmacological effects on the central nervous system and the effects on performance, both advantageous and adverse, before they can be considered for use in operations. Author

N87-25711# Massachusetts Inst. of Tech., Cambridge. Dept. of Brain and Cognitive Sciences.
USE OF TYROSINE AND OTHER NUTRIENTS TO ENHANCE AND SUSTAIN PERFORMANCE
Richard J. Wurtman *In* AGARD Biochemical Enhancement of Performance Mar. 1987 4 p (For primary document see N87-25709 19-52)
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Administration of supplemental tyrosine can increase the release of the catecholamines dopamine, norepinephrine, and epinephrine from physiologically-active neurons, and can thereby modify behaviors and other neuronal functions that are mediated by these neurotransmitters. The tyrosine acts by increasing the substrate saturation of the enzyme tyrosine hydroxylase; when a given neuron is firing frequently this enzyme becomes phosphorylated and, consequently, tyrosine-dependent. The amount of tyrosine that

enters the brain varies with the plasma tyrosine ratio, i.e., the ratio of the plasma tyrosine concentration to the summed concentrations of other large neutral amino acids that compete with tyrosine for transport across the blood-brain barrier. Hence, the administration of pure tyrosine is much more effective than eating proteins, which contain tyrosine: the proteins contain and deliver to the blood stream considerably larger amounts of the other large neutral amino acids. Tyrosine administration protects rats from the neurochemical and behavioral effects of stress; its ability to enhance performance of stressed humans is under exploration. Author

N87-25712# Army Research Inst. of Environmental Medicine, Natick, Mass.

DEVELOPMENT OF A PARADIGM TO ASSESS NUTRITIVE AND BIOCHEMICAL SUBSTANCES IN HUMANS: A PRELIMINARY REPORT ON THE EFFECTS OF TYROSINE UPON ALTITUDE- AND COLD-INDUCED STRESS RESPONSES

L. E. Banderet, H. R. Lieberman (Massachusetts Inst. of Tech., Cambridge.), R. P. Francesconi, B. L. Shukitt, R. F. Goldman, D. D. Schnakenberg, T. M. Rauch, P. B. Rock, and G. F. Meadors, III *In* AGARD Biochemical Enhancement of Performance Mar. 1987 12 p (For primary document see N87-25709 19-52)

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Tyrosine is the precursor for the catecholamine neurotransmitters dopamine and norepinephrine. Recent experiments have shown the behavior of animals given tyrosine is less impaired after stressful treatments than that of animals given placebo. Whether tyrosine administration would reduce adverse behavioral and physiological effects in humans was investigated by two combined environmental stressors, hypoxia and cold. Twenty-seven young male military volunteers were tested in a double-blind crossover design. The subjects were tested once with a placebo and once with tyrosine at a control condition and at two levels of multiple environmental stressors. Performance tests evaluated simple and choice reaction time to visual stimuli, viligance, and processing of symbolic, numerical, verbal, and spatial materials. Blood samples were analyzed for plasma tyrosine and cortisol concentrations. Performance, symptoms, and mood were adversely affected by both levels of high altitude and cold. Tyrosine administration appeared to minimize the adverse consequences of these stressors. Tyrosine enhanced performance and reduced subjective symptoms. Mood states were also improved. Tyrosine had more beneficial effects at progressively more stressful altitude and cold conditions. Author

N87-25713# Basel Univ. (Switzerland). Dept. of Surgery Research Div.

MULTIVARIATE AND PSYCHO-PHYSIOLOGICAL FUNCTIONS OF DSIP

Guido A. Schoenenberger, A. Ernst, and D. Schneider-Helmert *In* AGARD Biochemical Enhancement of Performance Mar. 1987 11 p (For primary document see N87-25709 19-52)

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From 1969 to 1977 the Delta-Sleep-Inducing-Peptide (DSIP) was isolated, characterized, and synthesized. Beside humoral sleep induction, DSIP acts upon the circadian rhythmicity of the locomotor activity and transmitter concentrations in the brain as well as on that of plasma proteins and cortisol levels in rats. The DSIP influences the prolactine levels and the circadian activity of N-Acetyl Transferase. The DSIP-like immunoreactive material showed a circadian rhythmicity in breast milk during normal lactation. The DSIP plasma concentrations also exhibit a rhythmic 24 h pattern, the amplitude of which apparently depends on the magnitude of body-exercise. The DSIP in humans was found also to exert a bell shaped dose response curve exhibiting an activating effect during awake states in situations conductive to sleep. Clinically and statistically significant effects upon sleep architecture were seen from 1 h through 20 h after injection; adverse effects were never observed. Single dose treatments of insomnia showed significant normalization effects of DSIP in all sleep parameters as did repeated administrations in chronic insomniacs. Daytime performance was found to improve after DSIP injections which at a higher dose exerted a beneficiary effect in organic insomniacs. In summary DSIP is suggested not only to be a sleep promoting and maintaining peptide but a supramodulatory active psychophysiological programming substance. Author

N87-25714# Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris (France). Div. de Neurophysiologie Appliquee.

INTRODUCTION OF A NEW STIMULANT: CRL 40476 [PRESENTATION D'UN NOUVEAU STIMULANT: LE CRL 40476]

C. L. Milhaud and D. P. Lagarde *In* AGARD Biochemical Enhancement of Performance Mar. 1987 7 p In FRENCH (For primary document see N87-25709 19-52)

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The use of simulants constitutes one of the possible approaches to maintaining vigilance during sustained, long-duration operations. The efficiency and safety of the stimulant CRL 40476 was evaluated using the macaque rhesus. Measurements of nocturnal activity, as well as the interpretation of electroencephalographic records provide evidence of a powerful anti-sleep effect without the disturbance of the sleep pattern. The safety studies showed an absence of side effects on vegetative and behavioral functions, particularly those typical of amphetamines, for the dosages utilized to maintain wakefulness. Operational experimentation will be able to provide a preliminary determination of effective doses and administration frequencies for healthy humans. M.G.

N87-25715# Cologne Univ. (West Germany). Neurobiologische Forschung.

PHARMACOLOGICAL APPROACHES TO PERFORMANCE ENHANCEMENT IN ANIMALS c51

D. G. Spencer, Jr., T. Schuurman, U. Benz, E. Horvath, and J. Traber *In* AGARD Biochemical Enhancement of Performance Mar. 1987 11 p (For primary document see N87-25709 19-52)

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Drug effects were studied on learning and working memory performance in young, normal rats, as well as on reactions to hypoxia and stress. While some of the treatments reduced cognitive parameters under normal conditions, none improved them in a meaningful way. However, several substances were found to improve performance distrupted by exposure to hypoxia. These substances included piracetam, nimodipine, and ipsapirone (TVX Q 7821). An additional characteristic of ipsapirone was an amelioration of negative responses to stress. Due to the well-understood mechanisms of action of nimodipine and ipsapirone, their low toxicity, and their lack of negative effects on normal cognitive performance, it is suggested that these drugs could prove to be useful therapeutic agents under conditions of high information processing loads. Author

N87-25716# Centre d'Essais en Vol, Bretigny-sur-Orge (France). Lab. de medecine Aerospatiale.

THE EVALUATION OF VIGILANCE IN STUDIES OF AERONAUTIC PHARMACOLOGY [L'EVALUATION DE LA VIGILANCE DANS LES ETUDES DE PHARMACOLLGIE EN AERONAUTIQUE]

J. L. Poirier and H. Vieillefond *In* AGARD Biochemical Enhancement of Performance Mar. 1987 8 p In FRENCH (For primary document see N87-25709 19-52)

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The design and results of various tests addressing two aspects of vigilance, psychomotor response and memorization, are described. The tests included short-term memorization tasks, visual conpensatory pursuit/tracking along two axes coupled with a secondary task measuring the response time of the subject to a visual cue, and visual pursuit tasks in a dynamic simulated-flight environment. The effects of four drugs were assessed: the psychotrope Medifoxamine 50, the antihistamine Astemizole, the psychostimulant Debrumyl, and the vasodilator RU 24722. M.G.

N87-25717# Centre d'Essais en Vol, Bretigny-sur-Orge (France). Lab. de Medecine Aerospatiale.

THE EFFECT OF ACETYL-DL-LEUCINE ON THE VESTIBULO-OCCULAR REFLEX IN HUMANS [EFFET DE L'ACETYL-DL-LEUCINE SUR LA PERFORMANCE DU REFLEXE VESTIBULO-OCCULAIRE CHEZ L'HOMME]

A. Leger, D. Lejeune, and H. Vieillefond *In* AGARD Biochemical Enhancement of Performance Mar. 1987 8 p In FRENCH (For primary document see N87-25709 19-52)

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The effect of the antivertiginous agent acetyl-dl-leucine on the vestibulo-occular reflex was tested. Twelve volunteers were administered the drug or a placebo via intravenous injection and subjected to vestibular stimulation. Electro-occulography was used to record horizontal nystagmus during and after rotations. The results demonstrate that acetyl-dl-leucine, administered at therapeutic doses, did not alter the quantitative characteristics of the vestibulo-occular reflex. M.G.

N87-25718# Harvard Medical School, Boston, Mass. Dept. of Physiology and Biophysics.

HOMEOSTATIC, ENTRAINMENT AND PACEMAKER EFFECTS OF DRUGS THAT REGULATE THE TIMING OF SLEEP AND WAKEFULNESS

Martin C. Moore-Ede and Thomas A. Houpt *In* AGARD Biochemical Enhancement of Performance Mar. 1987 9 p (For primary document see N87-25709 19-52)

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The timing of wakefulness and sleep in humans and other diurnal primates is influenced not only by the duration of prior wakefulness or prior sleep, but also by the phase of the circadian timing system. In continuous, round-the-clock operations, or with transportation between time zones, conflicts frequently occur between these determinants of arousal state. The predictive circadian component favors wakefulness and sleep at phases consistent with the recent history of environmental and internal time cues. On the other hand, the reactive homeostatic component is principally determined by the length of prior wakefulness on the particular day in question. Investigations of pharmacological agents which influence the timing of sleep and wakefulness indicate they may exert their effects directly on the neuronal/humoral mechanisms responsible for the generation of sleep, or by altering the phase of the circadian system. The circadian effects may either be achieved by influencing the interaction between environmental light-dark cycles and circadian pacemakers. Examples of drugs which appear to have predominantly homeostatic effects, pacemaker effects, or entrainment effects are discussed. An appropriate strategy for the management of alert wakefulness at any hour of day and night must use the appropriate pharmacological tools to manage circadian and homeostatic components of wakefulness and sleep. Author

N87-25719# Secretariat General de la Defense Nationale, Paris (France).

SIDE EFFECTS OF HYPNOTIC BENZODIAZEPINES ON THE VIGILANCE AND EFFICIENCY OF PERSONNEL AFTER AWAKENING [EFFETS RESIDUELS DES BENZODIAZEPINES HYPNOTIQUES SUR LA VIGILANCE ET L'EFFICIENCE DES PERSONNELS AU REVEIL]

L. Crocq and M. A. Crocq *In* AGARD, Biochemical Enhancement of Performance Mar. 1987 13 p In FRENCH (For primary document see N87-25709 19-52)

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In order to detect and evaluate the side effects of hypnotic benzodiazepines on the vigilance and efficiency of personnel after awakening, a double blind study was performed with three hypnotic benzodiazephines which satisify military operational requirements. At four day intervals sixteen subjects were administered one of five substances in uncertain order (placebo, Loprazolam 1 mg, Triazolam 0.25 mg, Triazolam 0.50 mg, and Flunitrazepam 1 mg). On awakening, psychometric tests were performed which determined the subjective state, attention, psychomotor efficiency, short- and long-term memory, mathematical reasoning, performance with complex tasks, and performance with information overload. The results showed the existence of a psychometric deterioration, manifested in the final test scores, with higher intellectual functions (reasoning, complex tasks, and information overload) being more greatly affected than gross aptitudes (attention and memory). However, differences in noticable deterioration were evident between subject groups and individuals and between the various drugs. M.G.

N87-25720# Naval Health Research Center, San Diego, Calif. Behavioral Psychopharmacology Dept.

SEDATING AND NONSEDATING SLEEPING AIDS IN AIR OPERATION

Cheryl L. Spinweber *In* AGARD Biochemical Enhancement of Performance Mar. 1987 12 p Sponsored by the Department of the Navy (For primary document see N87-25709 19-52)

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Both sedating and nonsedating sleeping aids may be appropriate for use in specific operational environments to promote sleep and permit efficient utilization of rest periods. Sedating agents, such as the benzodiazeprine triazolam, produce an impairment window which is a period of time postadministration when performance and responsivity during sleep are impaired. Nonsedating agents, such as the amino acid l-tryptophan, enhance sleep but do not alter performance of responsivity at any time postadministration. In a field trial of the use of l-tryptophan in the U.S. Marines airlifted from California to Okinawa, l-tryptophan increased total sleep time the first night after arrival. This sleep enhancement was associated with signifiacntly faster reaction times the next day, sparing of short-term memory from jet-lag effects, and more rapid recovery of reaction time over the first three days after arrival. Which type of agent to use in support of an air operation will be determined by the nature of the environments in which rest periods will occur and the duration of scheduled sleep times. Author

N87-25721# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.

FB-111A AIRCREW USE OF TEMAZEPAM DURING SURGE OPERATIONS

William F. Storm and Robert C. Parke *In* AGARD Biochemical Enhancement of Performance Mar. 1987 12 p (For primary document see N87-25709 19-52)

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The objectives of this field study were to evaluate the performance capabilities and sleep patterns of USAF FB-111A aircrews using temazepam as a sleep aid during premission crew rest. Seven 2-man aircrews participated in two data collection periods. During each period, a crew flew a pair of extended duration nighttime missions, one each on consecutive nights. The mission on the first night was an actual FB-11A training mission. The mission the subsequent night was flown in a high-fidelity simulator. Crews were administered 30 mg temazepam for the daytime crew rest interval between one pair of actual and simulated missions and a placebo for the crew rest between the other pair of missions. Sleep during daytime crew rest was of longer duration and better quality with temazepam than with the placebo. Twelve hours after drug ingestion, aircrew performance of the simulator missions and selected laboratory tests was similar to that with the placebo. Author

N87-25722# Service de Sante pour l'Armee de l'Air, Paris (France). Dept. de Psychiatrie et Hygiene Mentale Aerospatiales.

PHOBIC MANIFESTATIONS AMONG EXPERIENCED PILOTS [LES MANIFESTATIONS PHOBIQUES CHEZ LES PILOTES CONFIRMES]

J. R. Galle-Tessonneau *In* AGARD Biochemical Enhancement of Performance Mar. 1987 5 p In FRENCH (For primary document see N87-25709 19-52)

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Fear-of-flight phobic responses are not uncommon among experienced pilots. The associated clinical expressions are numerous and varied: psychological, somatic, or behavioral. Early

therapeutic intervention of acute reaction states is often favorable. The prognosis is most uncertain in organized pathological conditions and evolving chronic modes. M.G.

N87-25723 Defence Research Information Centre, Orpington (England).
SHIFT WORK AND BIOLOGICAL RHYTHMS
J. Rutenfranz Nov. 1986 19 p Transl. into ENGLISH from Arzneimittel-Forschung/Drug Research no. 28 (2), (West Germany), v. 10a, 1978 p 1867-1872
(DRIC-T-7825; BR101102; ETN-87-99827) Copyright Avail: NTIS Issuing Activity

Technological, economic, and social reasons for the introduction of shift work are reviewed. The extent of its use and its effect on the health of workers are discussed. Some 10% to 20% of shift workers suffer illness, mainly of the gastrointestinal tract, and a larger number experience feelings of ill health, principally sleep disorders and food intake disorders. These effects are attributed to individual predisposition, the disturbance of sleep by noise on the day after night work, and difficulties in adapting biological functions to changes in the times of work and sleep. ESA

N87-25724# Colorado Univ., Denver. Health Sciences Center.
OPERATION EVEREST 2: HIGH ALTITUDE PULMONARY HYPERTENSION UNRESPONSIVE TO OXYGEN
Bertron M. Groves, John T. Reeves, John R. Sutton, Peter D. Wagner, and Allen Cymerman Jan. 1987 50 p
(Contract DAMD17-85-C-5206)
(AD-A179882) Avail: NTIS HC A03/MF A01 CSCL 06J

High altitude increases pulmonary arterial pressure (PAP) presumably via alveolar hypoxia. No measurements of PAP have been made in man above 15000 feet (4572m). Eight male athletic volunteers simulated an ascent of Mt. Everest by living in a hypobaric chamber 40 days while being slowly decompressed to a barometric pressure (PB) of 240 mmHg. We expected to find the development of severe pulmonary hypertension which would be partially reversible with acute oxygen breathing. Hemodynamic measurements including right arterial, pulmonary arterial, wedge and systemic arterial pressures and cardiac output were made at rest and during upright cycle exercise breathing ambient air and 100% oxygen. Acute oxygen breathing lowered the cardiac output and PAP but did not lower PVR. Systemic pressure and resistance did not rise with progressive altitude but were increased during oxygen breathing, thus demonstrating a behavior of the systemic circulation which is different from the pulmonary vasculature. We concluded that the severe chronic hypoxia caused modest pulmonary hypertension not accompanied by right heart failure not immediately reversed by oxygen breathing. GRA

N87-25725# Army Research Inst. of Environmental Medicine, Natick, Mass.
MAXIMAL AEROBIC CAPACITY FOR REPETITIVE LIFTING: COMPARISON WITH THREE STANDARD EXERCISE TESTING MODES
M. A. Sharp, E. Harman, J. A. Vogel, J. J. Knapik, and S. J. Legg 12 Feb. 1987 32 p
(AD-A179985) Avail: NTIS HC A03/MF A01 CSCL 06J

The purpose of this study was to develop a reliable multi-stage repetitive lifting VO2max test to be used as a laboratory tool, which paralleled standard ergometer VO2max testing procedures. A secondary purpose was to compare the repetitive lifting VO2max test responses to those obtained during treadmill, cycle ergometer and arm crank ergometer tests utilizing similar testing procedures. The economy of maximal and submaximal repetitive lifting exercise was examined and compared to that of leg cycling and arm cranking. GRA

N87-25726# Army Research Inst. of Environmental Medicine, Natick, Mass.
ENDOCRINOLOGICAL RESPONSES TO EXERCISE IN STRESSFUL ENVIRONMENTS
Ralph P. Francesconi 16 Mar. 1987 60 p
(AD-A180011) Avail: NTIS HC A04/MF A01 CSCL 06I

The metabolic, thermoregulatory, and fluid-regulatory adjustments which occur during exercise, even under relatively moderate environmental conditions, may be concomitant with endocrine and neuroendocrine responses involving the hypothalamus, pituitary, adrenal, thyroid, sex glands, and pancreas. Reviews of studies investigating these relationships have been published previously; the imposition of an environmental stress in the form of heat, cold, or high terrestrial altitude in many cases exacerbates the intensity of these endocrinological response in man and higher animals. The responsibility and lability of these hormonal adjustments, the availability and accessibility of the biological medium in man (plasma, serum, urine), and the recent development of specific quantitative techniques for micro-assay (high-pressure liquid chromatography, radioimmunoassay) have combined to produce numerous reports on the human endocrine/neuroendocrine response to exercise during heat, cold, or hypoxic stress. GRA

N87-25727# Army Research Inst. of Environmental Medicine, Natick, Mass.
INTRA-ABDOMINAL AND INTRA-THORACIC PRESSURES DURING LIFTING AND JUMPING
Everett A. Harman, Peter N. Frykman, Elizabeth R. Clagett, and William J. Kraemer Mar. 1987 37 p
(AD-A180030) Avail: NTIS HC A03/MF A01 CSCL 06J

To investigate intra-thoracic pressure (ITP) and intra-abdominal pressure (IAP) during lifting and jumping, 11 males were monitored as they performed the dead lift (DL), slide row (SR), leg press (LP), bench press (BP), and box lift (BL), at 50, 75 and 100% of each subject's 4-repetition maximum, the vertical jump (VJ), drop-jump (DJ) form 0.5 and 1.0 meter heights, and Valsalva maneuver (VM). Measurements were made of peak pressure, time from pressure rise to switch-marked initiation of body movement (TRISE), and time from the movement to peak pressure (TPEAK). The highest ITP and IAP occurred during VM (22.2 + or - 6.0 and 26.6 + or - 6.7 kPa respectively) with one individual reaching 36.9 kPa (227 mmHg) IAP. In ascending order of peak ITP during the highest resistance sets, the activities were SR, BP, VJ, DJ, DL, LP AND VM, while the order for IAP was BP, VJ, DJ, BL, DL, LP, SR and VM. Pressures significantly ($P<.05$) increased with amount of weight lifted and rose before but peaked after the weight moved. IAP rose earlier and was of greater magnitude than ITP. For the jumps, pressure rose and diminished before the feet lost contact with the ground. Drop-jump height did not affect pressure. Correlation of pressure with weight lifted was fair to good for most activities. GRA

N87-25728# Army Research Inst. of Environmental Medicine, Natick, Mass.
INFLUENCE OF FASTING ON CARBOHYDRATE AND FAT METABOLISM DURING REST AND EXERCISE IN MEN
Joseph J. Knapik, Carol N. Meredith, Bruce Jones, Linda Suek, Vernon R. Young, and William J. Evans 2 Mar. 1987 34 p Prepared in cooperation with Massachusetts Univ., Amherst and Tufts Univ., Boston, Mass.
(AD-A180036) Avail: NTIS HC A03/MF A01 CSCL 06D

Metabolic effects of an overnight fast or a 3.5-day fast were compared in 8 healthy young men at rest and during exercise to exhaustion at 45% VO2 max, glucose rate of appearance (Ra) and disappearance (Rd) were calculated from plasma glucose enrichment during a primed, continuous infusion of glucose. Serum substrates and insulin levels were also measured. Glycogen content of the m. vastus lateralis was determined in biopsies taken before and after exercise. At rest, glucose flux and whole body carbohydrate oxidation determined from the respiratory exchange ration were lower in F than PA but muscle glycogen levels were similar. During exercise, glucose flux, whole body carbohydrate oxidation and the rate muscle of glycogen utilization were significantly lower during the fast. In the PA state, glucose Ra and Rd increased together throughout exercise. However, in the F state Ra exceeded Rd during the first hour of exercise, causing an increase in plasma glucose to levels similar to those of the PA state. The increase in glucose flux was markedly less throughout

F exercise. Lower carbohydrate utilization in the F state at rest and during exercise was consistent with higher circulating fatty acids and ketone bodies, lower levels of plasma insulin and the maintenance of physical performance as reflected by similar time to exhaustion. GRA

N87-25729# Duke Univ., Durham, N. C.
ABSTRACTS OF PAPERS PRESENTED AT THE ANNUAL MEETING OF THE SOCIETY OF GENERAL PHYSIOLOGISTS (40TH) HELD IN WOODS HOLE, MASSACHUSETTS ON 4-7 SEPTEMBER 1986
1986 72 p Meeting held in Woods Hole, Mass., 4-7 Sep. 1986
(AD-A180080) Avail: NTIS HC A04/MF A01 CSCL 06D

This is a collection of abstracts concerning these topics: Plasma membranes; Calcium regulation; Neurotransmitters; Erythrocytes; Synapse; Sodium-potassium pump; and Calcium. GRA

N87-25730# Army Research Inst. of Environmental Medicine, Natick, Mass.
HEAT INTOLERANCE, HEAT EXHAUSTION MONITORED: A CASE REPORT Final Report
Lawrence E. Armstrong, Roger W. Hubbard, Patricia C. Szlyk, Ingrid V. Sils, and William J. Kraemer 23 Mar. 1987 19 p
(AD-A180090) Avail: NTIS HC A02/MF A01 CSCL 06J

A 32 year-old male (S.H.) monitored during an 8-day heat acclimation (HA) investigation, unexpectedly exhibited heat intolerance and heat exhaustion. Thirteen other males completed HA without indications of either heat intolerance or heat exhaustion. Because S.H. responded normally to HA on days 1 to 4, the intervention of an unknown host factor on days 5 to 8 was suggested. S.H.'s heat exhaustion episode (day 8) was apparently forewarned by loss of body weight and increased heart rate, skin temperature (days 5 to 8) and rectal temperature (days 7 to 8) during daily 90 min trials. His symptoms indicated classical salt depletion heat exhaustion, but the calculated salt deficit was mild. Post-heat exhaustion serum enzyme levels were either normal or acutely elevated. Blood beta-endorphin and cortisol levels were 6 times and 2 times greater than control values, respectively. This case report is unique because physiological measurements and blood analyses were performed before, during, and after heat intolerance and heat exhaustion. GRA

N87-25731# Essex Corp., Orlando, Fla.
THE EFFECTS OF ASYNCHRONOUS VISUAL DELAYS ON SIMULATOR FLIGHT PERFORMANCE AND THE DEVELOPMENT OF SIMULATOR SICKNESS SYMPTOMATOLOGY Final Report, 25 Apr. - 26 Dec. 1986
K. C. Uliano, E. Y. Lambert, R. S. Kennedy, and D. J. Sheppard 26 Dec. 1986 71 p
(Contract N61339-85-D-0026)
(AD-A180196; NAVTRASYSCEN-86-D-0026-1) Avail: NTIS HC A04/MF A01 CSCL 06J

This research effort involved an experiment investigating the effect of asynchronous visual delays on simulator flight performance and the development of simulator sickness symptomatology. The SH-60B Vertical Takeoff and Land (VTOL) Simulator, part of the Navy's Visual Technology Research Simulator (VTRS) program was used to investigate this issue. Twenty-five experienced pilots flew three 40- or 60-minute sessions with two simulator tasks (air taxi and slalom) under each of the lag conditions. Pilots flew one session per day for three days with the lag condition changing each day. Objective and self-report indices were collected and, while results showed no difference between lag conditions, paper-and pencil illness ratings reflected a high initial incidence of illness (46% on Day 1) followed by rapid adaptation upon subsequent exposure. Simulator performance, however, was differentially affected by lag with the longest lag producing the worst performance. Finally, relationships between sickness indices, flight performance data, and other variables are presented and discussed GRA

N87-25732# Army Research Inst. of Environmental Medicine, Natick, Mass.
MOOD STATES AT 1600 AND 4300 METERS HIGH TERRESTRIAL ALTITUDE
Barbara L. Shukitt and Louis E. Banderet 9 Dec. 1986 6 p
(AD-A180535; USARIEM-M-14-87) Avail: NTIS HC A02/MF A01 CSCL 06E

Personal anecdotes imply that ascent to high altitude causes mood changes such as depression, apathy, and drowsiness. Also, behaviors at high altitude suggests that people are more argumentative, irritable, or euphoric. Since there are few systematic and quantitative studies assessing the effects of altitude on mood; this study assessed mood at two different altitudes and times of day using a standardized scale. Self-rated moods were twice daily using the Clyde Mood Scale with 19 males and 16 females. Baseline (control) mood states were determined at 200 m. Moods were then assessed at 4300 m with one group and at 1600 m with the second group. Friendliness, clear thinking, dizziness, sleepiness, and unhappiness were affected at 4300 m. Only sleepiness changed at 1600 m. At altitude mood changes were different from baseline the day of arrival (1 to 4 hours), most severe after on day (18 to 28 hours), and back to baseline levels by day 2 (42 to 52 hours). Few time of day (morning to evening) differences were found. Therefore, this mood scale appears useful for assessing the effects of different altitudes on mood states. GRA

N87-25733* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 300)
Aug. 1987 77 p
(NASA-SP-7011(300); NAS 1.21:7011(300)) Avail: NTIS HC A05 CSCL 06E

This bibliography lists 232 reports, articles and other documents introduced into the NASA scientific and technical information system in July 1987. Author

N87-25734# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 21, NO. 1, JANUARY - FEBRUARY 1987
O. G. Gazenko, ed. 29 Apr. 1987 153 p Transl. into ENGLISH of Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 96 p
(JPRS-USB-87-003) Copyright Avail: NTIS HC A08/MF A01

Various topics in the fields of space biology and aerospace medicine are discussed. Aviation physiology, work capacity, pilot performance, blood chemistry, weightlessness effects, altitude and motion sickness, radiation damage, and the spectral rendition of vestibular nystagmus are among the topics covered. For individual titles, see N87-25735 through N87-25756.

N87-25735# Joint Publications Research Service, Arlington, Va.
CURRENT PROBLEMS OF AVIATION PHYSIOLOGY
N. M. Rudnyy and V. A. Bodrov *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 1-11 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 4-11 (For primary document see N87-25734 19-52)
Copyright Avail: NTIS HC A08/MF A01

A survey of current research concerns in the area of aviation physiology is given. Medical support of flight personnel, altitude sickness, personnel selection, hypoxia, motion sickness, visual displays, electroencephalographic investigations of the cerebral cortex, pilot training, and flight personnel fatigue are among the topics discussed. R.J.F.

N87-25736# Joint Publications Research Service, Arlington, Va.
PROBLEMS OF ASSESSING HUMAN FUNCTIONAL CAPACITIES AND PREDICTING HEALTH STATUS
S. G. Salivon *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 12-18 Transl. into ENGLISH from Kosmicheskaya

Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 12-17 (For primary document see N87-25734 19-52)
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Reports dealing with assessments of human functional capabilities and health prediction are reviewed. Emphasis is placed on a systemic approach to the study of the functional abilities of the healthy man and prediction of his health status. Interactions in the man-environment system and hierarchical patterns of the regulation of various functional systems are considered. Author

N87-25737# Joint Publications Research Service, Arlington, Va.
RELATIONSHIP BETWEEN INFORMATION AND ACTIVATION, AND MENTAL WORK CAPACITY OF OPERATORS **c53**
K. K. Ioseliani and B. N. Ryzhov *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 19-24 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 17-21 (For primary document see N87-25734 19-52)
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The diagnostic potential of a method used to assess mental performance of operators based on a combined application of the information carrying and psychophysiological expenditures of man is discussed. Psychophysiological cost was measured with respect to automatic responses and psychic stress. It was found that the extremums of the relationship between information and activation parameters were invariant. The data obtained suggest that the information-activation relationship may be used to advantage in the clinical and physiological evaluation of operators. Author

N87-25738# Joint Publications Research Service, Arlington, Va.
DYNAMICS OF HORMONES, SUGAR AND ELECTROLYTES UNDER HYPODYNAMIC CONDITIONS ACCORDING TO BLOOD BIOCHEMICAL PARAMETERS
V. V. Makarovskiy, Yu. P. Reznikov, A. F. Khalangot, and S. A. Zinkovskaya *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 25-32 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 21-27 (For primary document see N87-25734 19-52)
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Time-course variations in hormones, carbohydrates and electrolytes (specifically, cortisol, aldosterone, testosterone, T3, T4, sugar, potassium, sodium and chlorides) in the blood of essentially healthy men, aged 19 to 59 years, kept for 30 days in a closed life support system were measured. Subjects aged 48 to 59 years who performed regular exercises showed a higher stability of potassium, sodium and chlorides and a normalization of hormones by test day 30 in contrast to other groups of subjects. Author

N87-25739# Joint Publications Research Service, Arlington, Va.
EFFECT OF WEIGHTLESSNESS AND HYPOKINESIA ON VELOCITY AND STRENGTH PROPERTIES OF HUMAN MUSCLES
L. S. Grigoryeva and I. B. Kozlovskaya *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 33-37 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 27-30 (For primary document see N87-25734 19-52)
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The effects of short- and long-term microgravity and prolonged bed rest on velocity and strength parameters of leg muscles were measured by isokinetic dynamometry. It was found that long-term exposure to microgravity produced a more distinct decline of muscle strength than short-term exposure. Prolonged bed-rest led to greater strength losses than microgravity of comparable duration. Author

N87-25740# Joint Publications Research Service, Arlington, Va.
PROBABILITY OF ALTITUDE DECOMPRESSION DISORDERS AS A FUNCTION OF DURATION OF PRE-EXPOSURE TO HYPOBARIC ATMOSPHERE
V. I. Chadov, A. S. Tsivilashvili, and L. R. Iseyev *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 38-42 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 30-33 (For primary document see N87-25734 19-52)
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Healthy volunteers, aged 21 to 47, were kept in an altitude chamber. Before decompression to a residual pressure of 293.3 GPa, the test subjects were consecutively exposed to 1120 GPa for two hours and then to 733.3 GPa for 24, 18 or 12 hours. At 293.3 GPa the test subjects performed a moderate workload for 6 hours. It was concluded that prior to the use of a space suit with a working pressure of 0.3 kgf/square cm (293.3 GPa), the time of exposure to a hypobaric normoxic (29 to 30 percent O2) atmosphere with the total barometric pressure 733.3 GPa should not be less than 18 hours and it should preferably be 24 hours. In this situation decompression safety of 6 hours of extravehicular activity can be predicted with high probability. Author

N87-25741# Joint Publications Research Service, Arlington, Va.
SOME INDIVIDUAL DISTINCTIONS OF HUMAN ADAPTATION TO ALTITUDE
T. V. Berezovskiy, T. V. Serebrovskaya, and A. A. Ivashkevich *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 43-48 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 34-37 (For primary document see N87-25734 19-52)
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Two groups of healthy men, natives of lowlands who for one year lived and worked in chronic hypoxia (Group 1 at an altitude of 1680 m with P sub O sub 2 equals 120 mm Hg and Group 2 at an altitude of 3650 with P sub O sub 2 equals 90 mm Hg), were examined. The subjects showed a higher sensitivity of the respiratory system to hypoxia, an enhanced lung ventilation and circulation, a lower gas exchange and work capacity. Blood and metabolic test results are given. Author

N87-25742# Joint Publications Research Service, Arlington, Va.
ATROPINE TEST DISTINCTIONS IN INDIVIDUALS OF DIFFERENT AGE GROUPS
Kh. Kh. Yarullin and N. P. Artamonova *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 49-55 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 37-42 (For primary document see N87-25734 19-52)
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The diagnostic value of the atropine test was investigated in 47 essentially healthy men of different age groups (25 to 39, 40 to 49 and 50 to 59 years). The cardiovascular responses were evaluated from ECG recorded continuously for an hour after subcutaneous injection of 1.0 to 0.1 percent atropine sulphate. Atropine caused a two-stage effect of the cardiac chronotropic function. The first, bradycarditic, stage was induced by vagal stimulation while the second, tachycarditic, stage was, by contrast, produced by atropine blockade of the acetylcholine effect on m-cholino-receptors of myocardial cells. The atropine effect was identical in sign in all age groups. However, in the young group the bradycarditic effect was more distinct and atropine induced arrhythmias were more frequent. In the 50 to 59 years subjects the tachycarditic effect grew at a slower rate and the electric systole response to a higher heart rate was less pronounced.
Author

N87-25743# Joint Publications Research Service, Arlington, Va.
FLUID AND ELECTROLYTE CONTENT IN PREGNANT RATS AND THEIR OFFSPRING FOLLOWING FLIGHT ABOARD COSMOS-1514 BIOSATELLITE **c51**
Ye. I. Shakhmatova, Ye. A. Lavrova, Yu. V. Natochin, L. V. Serova, and L. A. Denisova *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 56-63 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 42-47 (For primary document see N87-25734 19-52)
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Female rats were flown on Cosmos 1514 for five days during gestation days 13 through 18. The rats showed a significant reduction of the Ca concentration in the liver and kidneys, a smaller decrease in the skin, and no changes in bones. The weight of the fetus decreased, its water content increased, and the Na, K, Ca and Mg remained the same. The 15 and 30 day pups of the rats did not exhibit any differences in the water and electrolyte content in the bones, skin, liver or kidneys compared to the controls. These data indicate that water and electrolyte homeostatis of growing fetuses was highly stable and the deviations that emerged under the influence of spaceflight factors quickly returned to normal. Author

N87-25744# Joint Publications Research Service, Arlington, Va.
EFFECT OF DIPHOSPHONATES ON DEVELOPMENT OF OSTEOPOROSIS IN HYPOKINETIC RATS **c51**
A. S. Kaplanskiy, G. N. Durnova, Z. F. Sakharova, and B. V. Morukov *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 64-68 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), vol. 21, no. 1, Jan. - Feb. 1987 p 47-51 (For primary document see N87-25734 19-52)
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Using histomorphometric methods, the effect of diphosphonates (hydroxydimethylamino-propylene disphosphonic acid and hydroxy-ethylene diphosphonic acid) on the development of osteoporosis in spongy matter of tibia and vertebrae of rats exposed to hypokinesia for 60 days was investigated. It was found that aminoprophlene diphosphonic acid in the dose 6 mg phosphorus/kg/day prevented osteoporosis. Ethylene diphosphonic acid in the dose 9 mg phosphorus/kg/day reduced the severity of osteoporosis, but did not prevent it. Author

N87-25745# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF INCIDENCE OF MORPHOLOGICAL CHANGES IN RAT CEREBRAL CORTEX NEURONS UNDER THE EFFECT OF ACCELERATED CARBON IONS **c51**
B. S. Fedorenko, R. A. Kabitsyna, G. N. Krivitskaya, V. I. Derevyagin, and N. I. Ruzhov *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 69-74 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 51-55 (For primary document see N87-25734 19-52)
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Structural lesions in neurons of the brain cortex of rats were investigated 1 to 3 months after their exposure to accelerated carbon ions with the energy 320 MeV/nuclon 10,000 particles/square cm as well as to gamma radiation in the dose 1.0 Gy. The irradiated animals showed morphofunctional, dystrophic and reparative lesions in neurons. The rats exposed to carbon ions developed more distinct changes than the animals exposed to gamma radiation. It is postulated that similar fluxes of cosmic radiation will not produce deleterious effects upon the central nervous system of cosmonauts. Author

N87-25746# Joint Publications Research Service, Arlington, Va.
THERMODYNAMIC STATE OF MULTICONSTITUENT CO2=CO=H2O=H2=N2 GAS MIXTURE IN ELECTROLYZER WITH SOLID ELECTROLYTE **c25**
B. G. Grishayenkov and N. G. Zorina *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 75-80 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, Jan. - Feb. 1987 p 55-58 (For primary document see N87-25734 19-52)
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The thermodynamic state of the gas mixture CO2 = CO = H2O = H2 = N2 in the cathode space of the electrolyzer containing a solid electrolyte is investigated. Equations of four independent reactions are used to describe thermodynamic equilibrium of the gas mixture. Particular cases that occur when one, two or more conditions of the technological process are not satisfied are considered. Author

N87-25747# Joint Publications Research Service, Arlington, Va.
CENTRAL HEMODYNAMICS OF MONKEYS IN POSTOPERATIVE PERIOD AS RELATED TO HANDLING PRIOR TO SURGICAL INTERVENTION **c51**
R. T. Kazakova, V. P. Krotov, and I. O. Giryayeva *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 81-84 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 58-60 (For primary document see N87-25734 19-52)
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Cardiac function of monkeys was examined at different time intervals after electrode and transducer implantation. The study was carried out using 26 rhesus monkeys under ketalar anesthesia. The effect of this surgical intervention depended upon the initial health of the monkeys. Prior to the operation the pumping function declined due to diminished motor activity of the animals. It decreased to a greater extent 10 to 15 days after the operation. When normal activity was allowed for even a short time before surgical implantation, this was sufficient for normalization of the cardiovascular function. Author

N87-25748# Joint Publications Research Service, Arlington, Va.
PRESSURE AND VOLUME PULSATION WITH CHANGE IN SPARE ROOM IN INTRACRANIAL CAVITY
L. G. Simonov and A. S. Saribekyan *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 85-92 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 61-66 (For primary document see N87-25734 19-52)
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Changes in the amplitude and phase characteristics of pulse variations of volumes and pressures in response to an increase in the intracranial pressure are discussed. The study of 60 neurosurgical patients shows that as the intracranial pressure grows the amplitude of pulse variations of subdural pressure increases to 30 mm Hg and then decreases, the phase characteristics of the pulse waves changing accordingly. Author

N87-25749# Joint Publications Research Service, Arlington, Va.
COMPARATIVE STUDY OF CENTRAL HEMODYNAMICS, MYOCARDIAL CONTRACTILITY AND LEFT VENTRICULAR WALL TENSION IN ATHLETES AND PATIENTS
B. A. Khodos and V. L. Gabinskiy *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 93-99 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 66-71 (For primary document see N87-25734 19-52)
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The purpose of this study was to extend our knowledge about the athletic heart and improve diagnosis of latent manifestations of cardiac insufficiency. Echocardiography was used to examine central hemodynamics, myocardial contractility and left ventricle wall tension in athletes and patients with ischemic heart disease (IHD) and arterial hypertension at rest and after exercise. The study of time course variations of these parameters revealed

different patterns of initial dilation and development of further dilation and hypertrophy. The most sensitive index of contractility was meridional and circular tension of the left ventrical wall which was the lowest in athletes and the highest in IHD patients.
Author

N87-25750# Joint Publications Research Service, Arlington, Va.
SPECTRAL RENDITION OF VESTIBULAR NYSTAGMUS
A. V. Telezhnikov, V. G. Bazarov, V. L. Tsygankov, M. V. Kulikova, and N. S. Mishchanchuk *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 100-104 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 71-73 (For primary document see N87-25734 19-52)
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A spectral analysis of an electronystagmogram (ENG) obtained during the Barany rotation test at an angular velocity of 180 degrees/s for 20 s was performed. The spectrum of individual nystagmic movements of the clonic and tonic types were analyzed as a function of change in the relationship of fast and slow phases.
Author

N87-25751# Joint Publications Research Service, Arlington, Va.
RECOVERY OF SMALL AMOUNTS OF WATER IN THE DESERT c54
G. N. Sadikov *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 105-108 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 74-75 (For primary document see N87-25734 19-52)
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A method is proposed for the recovery of small amounts of water for the support of aircraft crews who have made a forced landing in the desert. The portable emergency kit contains 4 to 5 polyethylene bags, the weight of which would be 320 to 400 g. One can recover 50 to 55 ml of water from a bush of average size for a daily total of 2.2 to 2.4 l. The method involves placing the polyethylene bag over plants and then collecting the water that condenses inside the bag.
Author

N87-25752# Joint Publications Research Service, Arlington, Va.
DYNAMICS OF PSYCHOLOGICAL STATE DURING PERFORMANCE OF PROFESSIONAL WORK CONSISTING OF AIR TRAFFIC CONTROL c53
A. F. Denisov *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 109-113 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, Jan. - Feb. 1987 p 76-78 (For primary document see N87-25734 19-52)
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The dynamics of the mental states of air traffic controllers exposed to professional workloads were studied. Seventy air traffic controllers up to 35 years of age, with an average work tenure of seven years were studied.
Author

N87-25753# Joint Publications Research Service, Arlington, Va.
CONCEPTIONS OF AUTOMATION OF STUDIES OF OPERATOR PERFORMANCE c53
V. M. Drozhzhin *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 114-117 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 78-80 (For primary document see N87-25734 19-52)
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Some possibilities relative to organizing the study of pilot performance on a model of computer engineering are discussed. The organization of microprocessor systems, graphic display of data, and the preprocessing of physiological curves at the pace of the experiment are discussed.
R.J.F.

N87-25754# Joint Publications Research Service, Arlington, Va.
EFFECT OF ADEQUATE STIMULATION OF VESTIBULAR ANALYZER ON ACOUSTIC EVOKED POTENTIALS WITH AVERAGE LATENCY PERIOD
V. P. Ovsyanik, E. A. Bakay, V. V. Gurik, R. Sh. Karimov, S. L. Udovik, and L. S. Kovalenko *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 118-121 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 80-82 (For primary document see N87-25734 19-52)
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The objective was to analyze changes in amplitude of mean latency period acoustic evoked potentials (MAEP) before and after stimulation of the vestibular analyzer (VA) in subjects differing in vestibular stability. The studies indicate that vestibular stimulation of the chosen intensity leads to a reliable change in amplitude of components of acoustic evoked potentials of average latency period. Reliable differences are particularly significant in individuals with low vestibular stability. At the same time, the level and dynamics of changes in amplitudes of MAEP components after one or several cycles of adequate VA stimulation differed reliably in subjects differing in vestibular stability.
Author

N87-25755# Joint Publications Research Service, Arlington, Va.
EVOKED POTENTIALS WITH LONG LATENCY PERIOD IN MAN WITH EXPOSURE TO LINEAR ACCELERATIONS
V. P. Ovsyanik and S. L. Udovik *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 122-128 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 82-87 (For primary document see N87-25734 19-52)
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The objective was to single out complex evoked potentials (CEP) in the bioelectrical activity (BA) of the human cerebral cortex which were induced by linear accelerations. Results indicated that with exposure to linear accelerations of the chosen range it was possible to single out CEP on the encephalogram. There was good reproducibility of parameters under identical conditions for the same subjects. It was learned that a change in head position in relation to the vertical lines leads to change in form and parameters of CEP.
Author

N87-25756# Joint Publications Research Service, Arlington, Va.
HUMAN BLOOD LACTATE DEHYDROGENASE ISOZYME COMPOSITION WITH SINGLE EXPOSURE TO ACUTE HYPOXIA, AND ITS LINK TO PHYSICAL WORK CAPACITY
T. V. Serebrovskaya, A. N. Krasyuk, and V. N. Fedorovich *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 129-133 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 87-89 (For primary document see N87-25734 19-52)
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The objective was to investigate changes in lactate dehydrogenase (LDH) isozyme composition of human red blood cells during conditioning with acute hypoxia and to explore possible links between these changes and physical work capacity. Results revealed that hypoxia conditioning elicits changes in both overall LDH activity in a hemolysate of human blood and its isozyme spectrum.
Author

N87-25891*# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
GENERAL PURPOSE ALGORITHMS FOR CHARACTERIZATION OF SLOW AND FAST PHASE NYSTAGMUS
Charles S. Lessard *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 31 p (For primary document see Summer Faculty Fellowship Program, 1986,

Volume 2 31 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 06P

N87-25900*# Houston Univ., Tex. Dept. of Human Development.
BONE DENSITY IN LIMB-IMMOBILIZED BEAGLES: AN ANIMAL MODEL FOR BONE LOSS IN WEIGHTLESSNESS
Ira Wolinsky *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 6 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 6 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 06B

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N87-25757# Army Research Inst. of Environmental Medicine, Natick, Mass.
MOOD STATES AT 1600 AND 4300 METERS TERRESTRIAL ALTITUDE
Barbara L. Shukitt and Louis E. Banderet Jan. 1987 19 p
(AD-A179901) Avail: NTIS HC A02/MF A01 CSCL 05I

Personal anecdotes suggest that ascent to high altitude can cause mood changes such as depression, apathy, and drowsiness. Behaviors at high altitude indicate that people can become more argumentative, irritable, or euphoric. Since there are few systematic and quantitative studies assessing the effects of altitude on mood, this study compared moods at two different altitudes and times of day (morning - evening) using a standardized scale. The Clyde Mood Scale was used twice daily to determine self-rated moods in 19 males and 16 females. Baseline values were determined at 200 m; moods were then assessed at 4300 m with one group and at 1600 m with a second group. Friendliness, clear thinking, dizziness, sleepiness, and unhappiness were affected at 4300 m. Only sleepiness changed at 1600 m. At 4300 m, moods differed from baseline on the day arrival (1-4 hours), differed even more after one day(18 - 28 hours), and returned to baseline levels by day 2(42 - 52 hours). Morning and evening values did not differ at 200, 1600, or 4300 m, except for sleepiness at 4300 m. Therefore, mood states have a characteristic time course at altitude which is similar to that for acute mountain sickness symptomatology. GRA

N87-25758# Materials Research Labs., Ascot Vale (Australia).
THE EFFECT OF INSTANTANEOUS FIELD OF VIEW ON SEARCH RATE FOR SINGLE TARGETS OVER A WIDE FIELD
C. J. Woodruff and M. Folkard Nov. 1986 24 p
(AD-A180199; MRL-R-1032) Avail: NTIS HC A02/MF A01 CSCL 17E

The effect of the instantaneous field-of-view in searching a complex, wide-angle field viewed at fixed resolution was examined by simulation. The results show a decelerated improvement with instantaneous field-of-view over the range 6.9 deg to 55 deg for a 55 deg search field. This improvement was attributable to increased slewing rate of the search window. GRA

N87-25759# Systems Control Technology, Inc., Arlington, Va.
AERONAUTICAL DECISION MAKING FOR HELICOPTER PILOTS
Richard Adams and Jack Thompson Feb. 1987 133 p
(Contract DTFA01-80-C-10080)
(AD-A180325; DOT/FAA/PM-86/45) Avail: NTIS HC A07/MF A01 CSCL 01C

Aviation accident data indicate that the majority of aircraft mishaps are due to judgment errors. This training manual is part of a project to develop materials and techniques to help improve pilot decision making. This manual is designed to explain the risks associated with helicopter flying activities, the underlying behavioral causes of typical accidents, and the effects of stress on pilot decision making. It provides a means for the individual pilot to develop an Attitude Profile through a self-assessment inventory and provides detailed explanations of pre-flight and in-flight stress management techniques. The assumption is that pilots receiving this training will develop a positive attitude toward safety and the ability to effectively manage stress while recognizing and avoiding unnecessary risk. The examples used are taken from real accident and incident reports. GRA

N87-25760*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WORKSHOP ON WORKLOAD AND TRAINING, AND EXAMINATION OF THEIR INTERACTIONS: EXECUTIVE SUMMARY
Emanuel Donchin (Illinois Univ., Urbana-Champaign.), Sandra G. Hart, and Earl J. Hartzell Jul. 1987 40 p Workshop held in Carmel, Calif., 5-10 Jan. 1986
(NASA-TM-89459; A-87212; NAS 1.15:89459) Avail: NTIS HC A03/MF A01 CSCL 05H

The goal of the workshop was to bring together experts in the fields of workload and training and representatives from the Dept. of Defense and industrial organizations who are reponsible for specifying, building, and managing advanced, complex systems. The challenging environments and requirements imposed by military helicopter missions and space station operations were presented as the focus for the panel discussions. The workshop permitted a detailed examination of the theoretical foundations of the fields of training and workload, as well as their practical applications. Furthermore, it created a forum where government, industry, and academic experts were able to examine each other's concepts, values, and goals. The discussions pointed out the necessity for a more efficient and effective flow of information among the groups respresented. The executive summary describes the rationale of the meeting, summarizes the primary points of discussion, and lists the participants and some of their summary comments.
Author

N87-25761*# Georgia Inst. of Tech., Atlanta. Center for Man-Machine Systems Research.
OPERATOR FUNCTION MODELING: AN APPROACH TO COGNITIVE TASK ANALYSIS IN SUPERVISORY CONTROL SYSTEMS Annual Report
Christine M. Mitchell Aug. 1987 12 p
(Grant NAG2-413)
(NASA-CR-181180; NAS 1.26:181180) Avail: NTIS HC A01/MF A01 CSCL 05I

In a study of models of operators in complex, automated space systems, an operator function model (OFM) methodology was extended to represent cognitive as well as manual operator activities. Development continued on a software tool called OFMdraw, which facilitates construction of an OFM by permitting construction of a heterarchic network of nodes and arcs. Emphasis was placed on development of OFMspert, an expert system designed both to model human operation and to assist real human operators. The system uses a blackboard method of problem solving to make an on-line representation of operator intentions, called ACTIN (actions interpreter). J.P.B.

N87-25737# Joint Publications Research Service, Arlington, Va.
RELATIONSHIP BETWEEN INFORMATION AND ACTIVATION, AND MENTAL WORK CAPACITY OF OPERATORS
K. K. Ioseliani and B. N. Ryzhov *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 19-24 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 17-21 (For primary document see N87-25734 19-52)
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N87-25752# Joint Publications Research Service, Arlington, Va.
DYNAMICS OF PSYCHOLOGICAL STATE DURING PERFORMANCE OF PROFESSIONAL WORK CONSISTING OF AIR TRAFFIC CONTROL
A. F. Denisov *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 109-113 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, Jan. - Feb. 1987 p 76-78 (For primary document see N87-25734 19-52)
Copyright Avail: NTIS HC A08/MF A01

N87-25753# Joint Publications Research Service, Arlington, Va.
CONCEPTIONS OF AUTOMATION OF STUDIES OF OPERATOR PERFORMANCE
V. M. Drozhzhin *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 114-117 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 78-80 (For primary document see N87-25734 19-52)
Copyright Avail: NTIS HC A08/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N87-25762# National Academy of Sciences - National Research Council, Washington, D. C.
AIRLINER CABIN ENVIRONMENT: AIR QUALITY AND SAFETY Final Report
Aug. 1986 320 p
(Contract DTFA01-85-C-00013)
(PB87-164422; ISBN-0-309-03690-9) Avail: NTIS HC A14/MF A01 CSCL 13B

The report discusses the adequacy of air quality and standards aboard commercial aircraft for the health and safety of all who fly. Addressed are aspects of cabin air such as the quality of outside air, the quality of onboard air, the extent of pressurization, the characteristics of humidification, the presence of cosmic radiation, contaminants (such as bacteria, fungi, and other microorganisms), and pollutants (such as environmental tobacco smoke, carbon monoxide, carbon dioxide, and ozone) that could be responsible for health problems in the long or short run. It recommends some remedies for problems discovered, and outlines the safety precautions necessary to protect passengers in the event of in-flight fires which produce smoke and fumes. GRA

N87-25763*# Stanford Univ., Calif. Dept. of Mechanical Engineering.
DESIGN, DEVELOPMENT AND EVALUATION OF STANFORD/AMES EXTRA-VEHICULAR ACTIVITY (EVA) PREHENSORS Progress Report, Apr. 1986 - Mar. 1987
Larry J. Leifer, J. Jameson, M. LeBlanc, D. Wilson, E. Sabelman, and D. Schwandt Apr. 1987 46 p
(Contract NCC2-295)
(NASA-CR-181116; NAS 1.26:181116) Avail: NTIS HC A03/MF A01 CSCL 05H

A summary is given of progress to date on work proposed in 1983 and continued in 1985, including design iterations on three different types of manually powered prehensors, construction of functional mockups of each and culminating in detailed drawings and specifications for suit-compatible sealed units for testing under realistic conditions. Author

N87-25764# Coast Guard, Washington, D.C. Office of Research and Development.
AN EVALUATION OF HEAT STRAIN MONITORING METHODS FOR WORKERS IN ENCAPSULATING, IMPERMEABLE PROTECTIVE CLOTHING Final Report
W. D. Eley May 1987 65 p
(AD-A180555; USCG-D-12-87) Avail: NTIS HC A04/MF A01 CSCL 06J

Heat strain for six young, healthy, acclimized men (mean age 26.2 yrs., weight 84.1 kg) was measured during moderate exercise at various ambient conditions (21.5 C, 28 C, 31.5 C with sunshine), while wearing fully encapsulating chemical protective suits with self-contained breathing apparatus. The total weight of the Coast Guard Chemical Response Suit was 26.3 kg. The subjects performed a total of 35 minutes (20 minutes exercise, as determined by V(O2) measurements was 383 Kcal/hr. Heart rate and mean skin temperature rose significantly as ambient temperature increased. Under the most adverse ambient condition (31.5 C with sunshine), the mean heart rate and skin temperature were elevated 39.6 bpm and 4.1 C, respectively, over those recorded for control conditions. Significant increases in rectal temperature were not noted. Weight loss was observed only in the most severe ambient environment. The five minute recovery heart rate, recorded at minute 25 after 20 minutes of exercise, increased significantly as ambient temperature conditions became more adverse. It is concluded that wearers of impermeable protective clothing show progressive increases in heat strain as ambient temperature increases. This study indicates that recovery heart rate is probably the best indicator of heat tolerance endpoints for work in encapsulating, impermeable protective clothing. GRA

N87-25765*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
MULTI-ADJUSTABLE HEADBAND Patent Application
Pierce C. Toole, inventor (to NASA), Howard E. Chalson, inventor (to NASA), and Walter S. Bussey, inventor (to NASA) (Planning Research Corp., Kennedy Space Center, Fla.) 8 Aug. 1986 22 p
(NASA-Case-KSC-11322; US-Patent-Appl-SN-894541) Avail: NTIS HC A02/MF A01 CSCL 05H

This invention relates to a headband for a headset having separate coarse and fine adjustment features. The adjustments may be to the axial distance between at least one earpiece element and a side support. Such adjustment to the axial distance varies the pressure exerted on the head of the user. The present fine adjustment feature may be used while the headset is being worn, thereby permitting a user to optimize the amount of pressure between the contending criteria of comfort and keeping the headset in place on the user's head. NASA

N87-25766*# Umpqua Research Co., Myrtle Creek, Ore.
PRE- AND POSTTREATMENT TECHNIQUES FOR SPACECRAFT WATER RECOVERY Final Report
David F. Putnam, Gerald V. Colombo, and William F. Michalek Mar. 1987 103 p
(Contract NAS9-17073)
(NASA-CR-171987; NAS 1.26:171987; URC-70320) Avail: NTIS HC A06/MF A01 CSCL 06K

The objective was to develop techniques for satisfactory pretreatment of waste water (urine and wash water) prior to recovery by distillation and satisfactory post-treatment of the recovered water and humidity condensate for purification to the high quality necessary for reuse. The effort included literature and laboratory investigations, feasibility evaluations of candidate approaches, and development of conceptual designs for a waste water pretreatment system and a recovered water post-treatment system. Author

N87-25767*# Colorado Univ., Boulder. Dept. of Aerospace Engineering Sciences.
A METHOD OF VARIABLE SPACING FOR CONTROLLED PLANT GROWTH SYSTEMS IN SPACEFLIGHT AND TERRESTRIAL AGRICULTURE APPLICATIONS

J. Knox Oct. 1986 20 p
(NCC2-210)
(NASA-CR-177447; NAS 1.26:177447) Avail: NTIS HC A02/MF A01 CSCL 06K

A higher plant growth system for Controlled Ecological Life Support System (CELSS) applications is described. The system permits independent movement of individual plants during growth. Enclosed within variable geometry growth chambers, the system allocates only the volume required by the growing plants. This variable spacing system maintains isolation between root and shoot environments, providing individual control for optimal growth. The advantages of the system for hydroponic and aeroponic growth chambers are discussed. Two applications are presented: (1) the growth of soybeans in a space station common module, and (2) in a terrestrial city greenhouse. Author

N87-25768# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
FIRE SAFETY REQUIREMENTS FOR CABIN EQUIPMENT COMPONENTS [BRANDSICHERHEITSFORDERUNGEN AN BAUTEILE DER KABINENAUSSTATTUNG]
Juergen Grote 1986 57 p In GERMAN Presented at the Deutsche Gesellschaft fuer Metallkunde e.V. Seminar on Anwendung von Fasserverbundwerkstoffen, Lahnstein, West Germany, 6-9 Oct. 1986
(MBB-UT-020/86; ETN-87-99961) Avail: Issuing Activity

Fire safety requirements for the equipment of those parts of airliner compartments occupied by crew and passengers are reviewed. The legal prescriptions FAR 25.853, and the Airbus Industry prescription ATS 1000-001 concerning limiting values and test methods for smoke density and toxicity of the materials are investigated. Using the comparison between the FAA investigations on 1:1 and 1:4 test stands and the usual testing methods, the relation to extensions of the legal prescriptions, published in 1984, for new airliners from 1987 and 1988 on respectively, is explained. ESA

N87-25769# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
IMPACT OF FUTURE DEVELOPMENTS IN ELECTRONIC TECHNOLOGY ON COCKPIT ENGINEERING
R. Eggleston, ed. (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.) Jun. 1987 29 p
(AGARD-R-757; ISBN-92-835-1551-X) Copyright Avail: NTIS HC A03/MF A01

Presented are the results of the Cockpit Engineering subpanel of an AGARD workshop on The Potential Impact of Future Developments in Electronic Technology on the Future Conduct of Air Warfare held at the SHAPE Technical Center in The Hague, Netherlands, from 21 to 25 October 1985. The report considers the issue of how advances in electronics technology are expected to impact cockpit engineering for future airborne weapon systems, surveys the cockpit engineering problem, and provides a limited treatment of the considerations and developments believed to be needed to ensure that the potential offered by new electronic technologies is realized in future weapon systems. Author

N87-25751# Joint Publications Research Service, Arlington, Va.
RECOVERY OF SMALL AMOUNTS OF WATER IN THE DESERT
G. N. Sadikov *In its* USSR report: Space Biology and Aerospace Medicine, Volume 21, No. 1, January - February 1987 29 Apr. 1987 p 105-108 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 74-75 (For primary document see N87-25734 19-52)
Copyright Avail: NTIS HC A08/MF A01

N87-25897*# University of Southeastern Louisiana, Hammond. Dept. of Biological Sciences.
GENETIC TOXICITY STUDIES OF ORGANIC CHEMICALS FOUND AS CONTAMINANTS IN SPACECRAFT CABIN ATMOSPHERES
Joseph Torres, Jr. *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 14 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 14 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 06K

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N87-25770# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Automation Technology Div.
MICROPROCESSORS IN FACTORY AUTOMATION. A CASE STUDY OF AN AUTOMATED GUIDED VEHICLE SYSTEM AND ITS INTEGRATION INTO A HIERARCHICAL CONTROL STRUCTURE
T. Tempelmeier 1986 11 p Presented at the 12th Euromicro Symposium on Microprocessing and Microprogramming, Venice, Italy, 15-18 Sep. 1986
(MBB-Z-84/86; ETN-87-99976) Avail: Issuing Activity

The control and guidance mechanisms of an automated guided vehicle system (AGVS) are described, emphasizing features which enhance flexibility in the case of changes in the path layout. A concept for the integration of the control systems into a uniform structure, particularly transportation subsystems, is presented. Operating experience of the AGVS is discussed. ESA

N87-25771*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SURVEY OF CURRENTLY AVAILABLE HIGH-RESOLUTION RASTER GRAPHICS SYSTEMS
Denise R. Jones Jul. 1987 20 p
(NASA-TM-89139; L-16294; NAS 1.15:89139) Avail: NTIS HC A02/MF A01 CSCL 09B

Presented are data obtained on high-resolution raster graphics engines currently available on the market. The data were obtained through survey responses received from various vendors and also from product literature. The questionnaire developed for this survey was basically a list of characteristics desired in a high performance color raster graphics system which could perform real-time aircraft simulations. Several vendors responded to the survey, with most reporting on their most advanced high-performance, high-resolution raster graphics engine. Author

N87-25772*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HYPERCUBE MATRIX COMPUTATION TASK Final Report, 1986-1987
R. Calalo, W. Imbriale, P. Liewer, J. Lyons, F. Manshadi, and J. Patterson 1 Jul. 1987 122 p
(Contract NAS7-918)
(NASA-CR-180921; NAS 1.26:180921; JPL-Pub-87-18) Avail: NTIS HC A06/MF A01 CSCL 09B

The Hypercube Matrix Computation (Year 1986-1987) task investigated the applicability of a parallel computing architecture to the solution of large scale electromagnetic scattering problems. Two existing electromagnetic scattering codes were selected for conversion to the Mark III Hypercube concurrent computing environment. They were selected so that the underlying numerical algorithms utilized would be different thereby providing a more thorough evaluation of the appropriateness of the parallel environment for these types of problems. The first code was a frequency domain method of moments solution, NEC-2, developed at Lawrence Livermore National Laboratory. The second code was a time domain finite difference solution of Maxwell's equations to solve for the scattered fields. Once the codes were implemented on the hypercube and verified to obtain correct solutions by comparing the results with those from sequential runs, several measures were used to evaluate the performance of the two codes. First, a comparison was provided of the problem size possible on the hypercube with 128 megabytes of memory for a 32-node configuration with that available in a typical sequential user environment of 4 to 8 megabytes. Then, the performance of the codes was anlyzed for the computational speedup attained by the parallel architecture. Author

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

N87-25773# Oak Ridge National Lab., Tenn.
GAUSSIAN ELIMINATION WITH PARTIAL PIVOTING AND LOAD BALANCING ON A MULTIPROCESSOR
A. George and E. Chu 1986 23 p Presented at the International Conference on Vector and Parallel Computing, Leon, Norway, 2 Jun. 1986 Prepared in cooperation with Waterloo Univ., Ontario
(Contract DE-AC05-84OR-21400)
(DE87-005323; CONF-8606187-2) Avail: NTIS HC A02/MF A01

A row-oriented implementation of Gaussian elimination with partial pivoting on a local-memory multiprocessor is described. In the absence of pivoting, the initial data loading of the nodes processors leads to a balanced computation. However, if interchanges occur, the computational loads on the processors may become unbalanced, leading to inefficiency. A simple load balancing scheme is described which is inexpensive and which maintains computational balance in the presence of pivoting. Using some reasonable assumptions about the probability of pivoting occurring, an analysis of the communication costs of the algorithm is developed, along with an analysis of the computation performed in each node processor. This model is then used to derive the expected speed-up of the algorithm. Finally, experiments using an Intel iPSC hypercube are presented in order to demonstrate the extent to which the analytical model predicts the performance. DOE

N87-25774# Lawrence Livermore National Lab., Calif.
DI: AN INTERACTIVE DEBUGGING INTERPRETER FOR APPLICATIVE LANGUAGES
S. K. Skedzielewski, R. K. Yates, and R. R. Oldehoeft 12 Mar. 1987 13 p Presented at the Association for Computing Machinery/Special Interest Group on Programming Language Symposium: Interpreters and Interpretive Techniques, St. Paul, Minn., 24 Jun. 1987 Prepared in cooperation with Colorado State Univ., Fort Collins
(Contract W-7405-eng-48)
(DE87-006822; UCRL-95709; CONF-870675-1) Avail: NTIS HC A02/MF A01

The DI interpreter is both a debugger and interpreter of SISLAL programs. Its use as a program interpreter is only a small part of its role; it is designed to be a tool for studying compilation techniques for applicative languages. DI interprets dataflow graphs expressed in the IF1 and IF2 languages, and is heavily instrumented to report the activity of dynamic storage activity, reference counting, copying and updating of structured data values. It also aids the SISAL language evaluation by providing an interim execution vehicle for SISAL programs. DI provides determinate, sequential interpretation of graph nodes for sequential and parallel operations in a canonical order. As a debugging aid, DI allows tracing, breakpointing, and interactive display of program data values. DI handles creation of SISAL and IF1 error values for each data type and propagates them according to a well-defined algebra. We have begun to implement IF1 optimizers and have measured the improvements with DI. DOE

N87-25775*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COLLECTED SOFTWARE ENGINEERING PAPERS, VOLUME 3
Nov. 1985 141 p
(NASA-TM-89373; SEL-85-003-Vol-3; NAS 1.15:89373)
Copyright Avail: NTIS HC A07/MF A01; single copies available from NASA/GSFC, Code 552, Greenbelt, Md. 20771 CSCL 09B

Topics addressed include: software technology evaluation programs; collection of valid software engineering data; test processes using structural coverage; prototype expert system for software engineering management; use of an environment characteristic software metric set; software modulation; software development by analysis of change; and independent verification and validation. For individual titles, see N87-25776 through N87-25784.

N87-25776*# Computer Sciences Corp., Silver Spring, Md.
A SOFTWARE TECHNOLOGY EVALUATION PROGRAM
David N. Novaes-Card *In* NASA. Goddard Space Flight Center, Collected Software Engineering Papers, Volume 3 Nov. 1985 6 p (For primary document see N87-25775 19-61)
Avail: NTIS HC A07/MF A01; single copies available from NASA/GSFC, Code 552, Greenbelt, Md. 20771 CSCL 09B

A set of quantitative approaches is presented for evaluating software development methods and tools. The basic idea is to generate a set of goals which are refined into quantifiable questions which specify metrics to be collected on the software development and maintenance process and product. These metrics can be used to characterize, evaluate, predict, and motivate. They can be used in an active as well as passive way by learning form analyzing the data and improving the methods and tools based upon what is learned from that analysis. Several examples were given representing each of the different approaches to evaluation. The cost of the approaches varied inversely with the level of confidence in the interpretation of the results. Author

N87-25777*# Maryland Univ., College Park. Dept. of Computer Science.
FOUR APPLICATIONS OF A SOFTWARE DATA COLLECTION AND ANALYSIS METHODOLOGY
Victor R. Basili and Richard W. Selby, Jr. (California Univ., Irvine.) *In* NASA. Goddard Space Flight Center, Collected Software Engineering Papers, Volume 3 Nov. 1985 15 p Presented at the NATO Advanced Study Institute: The Challenge of Advanced Computing Technology to System Design Methods, Durham, England, 29 Jul. - 10 Aug. 1985 Submitted for publication (For primary document see N87-25775 19-61)
Avail: NTIS HC A07/MF A01; single copies available from NASA/GSFC, Code 552, Greenbelt, Md. 20771 CSCL 09B

The evaluation of software technologies suffers because of the lack of quantitative assessment of their effect on software development and modification. A seven-step data collection and analysis methodology couples software technology evaluation with software measurement. Four in-depth applications of the methodology are presented. The four studies represent each of the general categories of analyses on the software product and development process: blocked subject-project studies, replicated project studies, multi-project variation studies, and single project strategies. The four applications are in the areas of, respectively, software testing, cleanroom software development, characteristic software metric sets, and software error analysis. Author

N87-25778*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MEASURING THE IMPACT OF COMPUTER RESOURCE QUALITY ON THE SOFTWARE DEVELOPMENT PROCESS AND PRODUCT

Frank McGarry, Jon Valett, and Dana Hall (National Aeronautics and Space Administration, Washington, D.C.) *In its* Collected Software Engineering Papers, Volume 3 Nov. 1985 9 p (For primary document see N87-25775 19-61)

Avail: NTIS HC A07/MF A01; single copies available from NASA/GSFC, Code 552, Greenbelt, Md. 20771 CSCL 09B

The availability and quality of computer resources during the software development process was speculated to have measurable, significant impact on the efficiency of the development process and the quality of the resulting product. Environment components such as the types of tools, machine responsiveness, and quantity of direct access storage may play a major role in the effort to produce the product and in its subsequent quality as measured by factors such as reliability and ease of maintenance. During the past six years, the NASA Goddard Space Flight Center has conducted experiments with software projects in an attempt to better understand the impact of software development methodologies, environments, and general technologies on the software process and product. Data was extracted and examined from nearly 50 software development projects. All were related to support of satellite flight dynamics ground-based computations. The relationship between computer resources and the software development process and product as exemplified by the subject NASA data was examined. Based upon the results, a number of computer resource-related implications are provided. Author

N87-25779*# Maryland Univ., College Park. Dept. of Computer Science.

ANALYZING THE TEST PROCESS USING STRUCTURAL COVERAGE

James Ramsey and Victor R. Basili *In* NASA. Goddard Space Flight Center, Collected Software Engineering Papers, Volume 3 Nov. 1985 7 p (For primary document see N87-25775 19-61)
(Grant NsG-5123)

Avail: NTIS HC A07/MF A01; single copies available from NASA/GSFC, Code 552, Greenbelt, Md. 20771 CSCL 09B

A large, commercially developed FORTRAN program was modified to produce structural coverage metrics. The modified program was executed on a set of functionally generated acceptance tests and a large sample of operational usage cases. The resulting structural coverage metrics are combined with fault and error data to evaluate structural coverage. It was shown that in the software environment the functionally generated tests seem to be a good approximation of operational use. The relative proportions of the exercised statement subclasses change as the structural coverage of the program increases. A method was also proposed for evaluating if two sets of input data exercise a program in a similar manner. Evidence was provided that implies that in this environment, faults revealed in a procedure are independent of the number of times the procedure is executed and that it may be reasonable to use procedure coverage in software models that use statement coverage. Finally, the evidence suggests that it may be possible to use structural coverage to aid in the management of the acceptance test processed. Author

N87-25780*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A PRACTICAL EXPERIENCE WITH INDEPENDENT VERIFICATION AND VALIDATION

Gerald Page, Frank E. McGarry, and David N. Card (Computer Sciences Corp., Silver Spring, Md.) *In its* Collected Software Engineering Papers, Volume 3 Nov. 1985 5 p (For primary document see N87-25775 19-61)

Avail: NTIS HC A07/MF A01; single copies available from NASA/GSFC, Code 552, Greenbelt, Md. 20771 CSCL 09B

One approach to reducing software cost and increasing reliability is the use of an independent verification and validation (IV & V) methodology. The Software Engineering Laboratory (SEL) applied the IV & V methodology to two medium-size flight dynamics software development projects. Then, to measure the effectiveness of the IV & V approach, the SEL compared these two projects with two similar past projects, using measures like productivity, reliability, and maintain ablilty. Results indicated that the use of the IV & V methodology did not help the overall process nor improve the product in these cases. Author

N87-25781*# Maryland Univ., College Park. Computer Science Center.

ARROWSMITH-P: A PROTOTYPE EXPERT SYSTEM FOR SOFTWARE ENGINEERING MANAGEMENT

Victor R. Basili and Connie Loggia Ramsey *In* NASA. Goddard Space Flight Center, Collected Software Engineering Papers, Volume 3 Nov. 1985 13 p Presented at the Expert Systems in Government Symposium, 23-25 Oct. 1985 (For primary document see N87-25775 19-61)
(Grant NsG-5123)

Avail: NTIS HC A07/MF A01; single copies available from NASA/GSFC, Code 552, Greenbelt, Md. 20771 CSCL 09B

Although the field of software engineering is relatively new, it can benefit from the use of expert systems. Two prototype expert systems were developed to aid in software engineering management. Given the values for certain metrics, these systems will provide interpretations which explain any abnormal patterns of these values during the development of a software project. The two systems, which solve the same problem, were built using different methods, rule-based deduction and frame-based abduction. A comparison was done to see which method was better suited to the needs of this field. It was found that both systems performed moderately well, but the rule-based deduction system using simple rules provided more complete solutions than did the frame-based abduction system. Author

N87-25782*# Maryland Univ., College Park. Dept. of Computer Science.

FINDING RELATIONSHIPS BETWEEN EFFORT AND OTHER VARIABLES IN THE SEL

Victor R. Basili and N. Monina Panlilio-Yap *In* NASA. Goddard Space Flight Center, Collected Software Engineering Papers, Volume 3 Nov. 1985 8 p (For primary document see N87-25775 19-61)
(Grant NsG-5123)

Avail: NTIS HC A07/MF A01; single copies available from NASA/GSFC, Code 552, Greenbelt, Md. 20771 CSCL 09B

Estimating the amount of effort required for a software development project is one of the major aspects of resource estimation for that project. In this study, the relationship between effort and other variables for 23 Software Engineering Laboratory (SEL) projects that were developed for NASA/Goddard Space Flight Center was examined. These variables fell into two categories: those which can be determined in the early stages of project development and may therefore be useful in a baseline equation for predicting effort in future projects, and those which can be used mainly to characterize or evaluate effort requirements and thus enhance the understanding of the software development process in this environment. Some results of the analyses are presented. Author

N87-25783*# Maryland Univ., College Park. Dept. of Computer Science.
CALCULATION AND USE OF AN ENVIRONMENT'S CHARACTERISTIC SOFTWARE METRIC SET
Victor R. Basili and Richard W. Selby, Jr. (California Univ., Irvine.) *In* NASA. Goddard Space Flight Center, Collected Software Engineering Papers, Volume 3 Nov. 1985 6 p (For primary document see N87-25775 19-61)
(Grant NsG-5123)
Avail: NTIS HC A07/MF A01; single copies available from NASA/GSFC, Code 552, Greenbelt, Md. 20771 CSCL 09B

Since both cost/quality and production environments differ, this study presents an approach for customizing a characteristic set of software metrics to an environment. The approach is applied in the Software Engineering Laboratory (SEL), a NASA Goddard production environment, to 49 candidate process and product metrics of 652 modules from six (51,000 to 112,000 lines) projects. For this particular environment, the method yielded the characteristic metric set (source lines, fault correction effort per executable statement, design effort, code effort, number of I/O parameters, number of versions). The uses examined for a characteristic metric set include forecasting the effort for development, modification, and fault correction of modules based on historical data. Author

N87-25784*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRITERIA FOR SOFTWARE MODULARIZATION
David N. Card, Gerald T. Page (Computer Sciences Corp., Silver Spring, Md.), and Frank E. McGarry *In its* Collected Software Engineering Papers, Volume 3 Nov. 1985 6 p (For primary document see N87-25775 19-61)
Avail: NTIS HC A07/MF A01; single copies available from NASA/GSFC, Code 552, Greenbelt, Md. 20771 CSCL 09B

A central issue in programming practice involves determining the appropriate size and information content of a software module. This study attempted to determine the effectiveness of two widely used criteria for software modularization, strength and size, in reducing fault rate and development cost. Data from 453 FORTRAN modules developed by professional programmers were analyzed. The results indicated that module strength is a good criterion with respect to fault rate, whereas arbitrary module size limitations inhibit programmer productivity. This analysis is a first step toward defining empirically based standards for software modularization. Author

N87-25785# Kernforschungsanlage, Juelich (West Germany). Zentralinst. fuer Angewandte Mathematik.
A SOFTWARE PAGING SYSTEM FOR THE TREATMENT OF VERY LARGE MATRICES IN FORTRAN [EIN SOFTWARE-PAGING-SYSTEM FUER DIE BEARBEITUNG SEHR GROSSER MATRIZEN IN FORTRAN]
Ulrich Detert Sep. 1986 58 p In GERMAN; ENGLISH summary
(JUEL-SPEZ-372; ISSN-0343-7639; ETN-87-99657) Avail: NTIS HC A04/MF A01

A fast and flexible method for handling large FORTRAN data arrays (especially two-dimensional matrices) by a software paging mechanism, originally designed for use with CRAY mainframes is presented. The paging mechanism uses matrix segmentations with user-defined shape and size of blocks. The user interface is realized by a set of FORTRAN callable subroutines providing access to all matrix substructures. Performance data for various types of matrix segmentations are given, and two-page replacement strategies are compared. Together with the CRAY version, a portable version, written in standard FORTRAN 77, is provided; this version is mainly intended for use on IBM mainframes. A user's guide gives a summary of all routines contained in the softwere paging method. Program listings of typical routines are provided. ESA

N87-25786# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany). Transport Aircraft Div.
AUTOMATED SYSTEMS FOR THE MANUFACTURE OF AIRBUS VERTICAL STABILIZERS
Rudolf Berfranz 1986 6 p Presented at the 15th International Council of the Aeronautical Sciences (ICAS) Congress, London, England, 7-12 Sep. 1986
(MBB-UT-17-86; ETN-87-99960) Avail: Issuing Activity

A full series of Airbus vertical stabilizers with spar boxes in CFRP was produced using a module based production process, intended to become fully automatic. With full mechanization and automation, production costs are expected to be similar to those for a comparable all-metal structure. ESA

N87-25787# Johns Hopkins Univ., Baltimore, Md. Dept. of Electrical Engineering and Computer Science.
RECURSIVE LINEAR SMOOTHING FOR THE 2-D HELMHOLTZ EQUATION Interim Report
Laurence R. Riddle and Howard L. Weinert 25 Sep. 1986 32 p (Contract N00014-85-K-0255)
(AD-A179784; JHU/EE-86/20) Avail: NTIS HC A03/MF A01 CSCL 12A

A fast algorithm for reconstructing images governed by a 2-D Helmholtz equation is presented. The computational complexity of the algorithm is O(NMlogM) or O(N(M-sq) depending on boundary conditions, where N and M are the number of spatial grid points in the x and y directions respectively. This problem arises when smoothing a large number of images governed by the 2-D wave equation, because a Fourier transform in time gives a new set of images governed by the Helmholz equation. When the images come from a scattering process, we show that a linear least-squares Born inversion of the wave field amplitudes can be performed during the smoothing procedure without changing the computational complexity. The smoothing algorithm is well posed, and the sample functions of the smoothed estimate possess smoothness properties consistent with the Helmholtz equation. GRA

N87-25788# Army Construction Engineering Research Lab., Champaign, Ill.
DEVELOPMENT OF LITE: A GRAPHIC MODULE FOR LIGHTING ANALYSIS IN THE COMPUTER-AIDED ENGINEERING AND ARCHITECTURAL DESIGN SYSTEM (CAEADS) Final Report
Cynthia K. Barton Mar. 1987 84 p
(AD-A179821; CERL-TR-E-87/02) Avail: NTIS HC A05/MF A01 CSCL 13A

This report documents the development and use of the graphic module LITE, a subsystem of the Computer-Aided Engineering and Architectural Design System (CAEADS). LITE was developed to assist U.S. Army Corps of Engineers (USACE) in-house lighting engineers in performing the required analysis during the concept design phase. The program can do Illuminating Engineering Society (IES) Zonal Cavity calculations internally and, in addition, can build a Conservation of Electric Lighting (CEL-1) input deck for comprehensive daylighting studies. Also described is the LCHG program which was developed to maintain the luminaire data base file used by LITE for illuminance calculations. The LCHG program relies on textual rather than graphic interaction with the user. The data base is independent of any other project and can store an unlimited number of luminaires. The program is written in FORTRAN 77 and uses Tektronix 4109, 4014, and 4113 terminals of graphic representations. It is to be field-tested on selected USACE District/Division Harris computers beginning in early FY87. GRA

N87-25789# Naval Research Lab., Washington, D. C.
USING TRACE SPECIFICATIONS FOR PROGRAM SEMANTICS AND VERIFICATION Interim Report, Oct. 1985 - Sep. 1986
John McLean 10 Apr. 1987 16 p
(AD-A179845; NRL-9033) Avail: NTIS HC A02/MF A01 CSCL 09B

Traditional methods for proving program correctness use implementation-dependent specification methods. If abstract specifications are also used, these methods require a leap of faith to bridge the gap between an abstract specification and a program correctness statement. In this report the trace method of software specification is extended to provide a natural semantics for procedural programming languages. This extension is compared with other approaches for the giving program semantics and is

seen to provide a method for proving program correctness that avoids the problems of those currently in use. GRA

N87-25790# Rochester Univ., N. Y. Dept. of Computer Science.
DEBUGGING PARALLEL PROGRAMS WITH INSTANT REPLAY
Thomas J. LeBlanc and John M. Mellor-Crummey Sep. 1986 26 p
(Contract DACA76-85-C-0001; Grant NSF DCR-83-20136)
(AD-A179902; TR-194) Avail: NTIS HC A03/MF A01 CSCL 09B

The debugging cycle is the most common methodology for finding and correcting errors in sequential programs. Cyclic debugging is effective because sequential programs are usually deterministic. Debugging parallel programs is considerably more difficult because successive executions of the same program often do not produce the same results. In this paper we present a general solution for reproducing the execution behavior of parallel programs, termed Instant Replay. During program execution we save the relative order of significant events as they occur, not the data associated with such events. As a result, our approach requires less time and space to save the information needed for program replay than other methods. Our technique is not dependent on any particular form of interprocess communication. It provides for replay of an entire program, rather than individual processes in isolation. No centralized bottlenecks are introduced and there is no need for synchronized clocks or a globally-consistent logical time. The authors describe a prototype implementation of Instant Replay on the BBN Butterfly Parallel Processor, and discuss how it can be incorporated into the debugging cycle for parallel programs. Author (GRA)

N87-25791# Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.
A PORTABLE INTERACTIVE PLOTTER FOR DIGITAL X-Y DATA
Gordon C. Everstine Dec. 1986 17 p
(AD-A179963; DTNSRDC/CMLD-86/45) Avail: NTIS HC A02/MF A01 CSCL 09B

This report describes the use of a computer program called IPLOT (Interactive Plotting) for interactively generating X-Y plots of digital data. The program is built around the widely available DISSPLA (Display Integrated Software System and Plotting Language) plotting software in order to be as portable as possible. IPLOT has command and input file structures similar to those of the IDDS program used at DTNSRDC, except that IPLOT can label axed and generate logarithmic plots. A checkpoint/restart capability is included. GRA

N87-25792# Aerospace Corp., El Segundo, Calif. Computer Science Lab.
A METHOD FOR THE AUTOMATIC TRANSLATION OF ALGORITHMS FROM A HIGH-LEVEL LANGUAGE INTO SELF-TIMED INTEGRATED CIRCUITS
Steven H. Kelem 30 Sep. 1986 13 p
(Contract F04701-85-C-0086)
(AD-A180136; TR-0084A(5920-03)-1; SD-TR-86-60) Avail: NTIS HC A02/MF A01 CSCL 09B

A method for generating custom self timed integrated circuits (ICs) from algorithmic descriptions of the desired circuits is described. The goal is to quickly produce prototype integrated circuit masks that implement various algorithms and data types in order to evaluate the IC power, delay, and area characteristics. A topology and behavior preserving mapping is used to perform the translation from constructs in the function language to mask primitives. GRA

N87-25793# Massachusetts Univ., Amherst. Dept. of Mathematics and Statistics.
COMPUTATION AND GRAPHICS IN MATHEMATICAL RESEARCH Progress Report, 10 Jun. 1986 - 31 May 1987
D. A. Hoffman and J. Spruck Mar. 1987 13 p
(Contract DE-FG02-86ER-25015)
(DE87-008769; DOE/ER-25015/1) Avail: NTIS HC A02
(Contract DE-FG02-86ER-25015)
(DE87-008769; DOE/ER-25015/1) Avail: NTIS HC A02

We are actively developing and using interactive graphics software to study global problems in differential geometry, the calculus of variations and mathematical physics. The software is designed to be easily linked to numerical algorithms that solve partial differential equations so that the results of a computation can be immediately visualized and parameters of the problem can be modified as needed. Our aim has been to create an integrated environment where advanced graphics and high speed numerical computation are used to explore significant scientific problems. We have spent a great deal of time and effort designing such a facility and we have demonstrated the value of this approach to doing research. We have also made significant progress in joint work with a group of polymer scientists in the identification of fluid interfaces in block copolymers. DOE

N87-25794*# Computer Sciences Corp., Silver Spring, Md.
FLIGHT EXPERIMENT DEMONSTRATION SYSTEM (FEDS) ANALYSIS REPORT
D. E. Shank Jul. 1986 323 p
(Contract NAS5-27888)
(NASA-CR-177917; NAS 1.26:177917; CSC/TM-86/6034) Avail: NTIS HC A14/MF A01 CSCL 09B

The purpose of the Flight Experiment Demonstration System (FEDS) was to show, in a simulated spacecraft environment, the feasibility of using a microprocessor to automate the onboard orbit determination functions. The software and hardware configuration used to support FEDS during the demonstration and the results of the demonstration are discussed. R.J.F.

N87-25795# Texas Univ., Austin. Center for Cybernetic Studies.
A SEMI-INFINITE MULTICRITERIA PROGRAMMING APPROACH TO DATA ENVELOPMENT ANALYSIS WITH INFINITELY MANY DECISION-MAKING UNITS
A. Charnes, W. W. Cooper, and Q. L. Wei Jan. 1987 31 p
(Contract N00014-82-K-0295; Grants NSF SES-85-20806; NSF SES-84-08134)
(AD-A180180; CCS-RR-551) Avail: NTIS HC A03/MF A01 CSCL 09B

Via semi-infinite programming, Data Envelopment Analysis is extended to models with a (possibly) infinite number of Decision-Making Units in order to provide a simpler analytic structural base for forthcoming studies of statistical aspects. Relations with usual multicriteria problems are brought forth. In this paper, the only model considered is extension of phase one of the Charnes, Cooper, Thrall development of the CCR ratio model. GRA

N87-25796# Martin Marietta Aerospace, Denver, Colo.
SOFTWARE COST ESTIMATION STUDY Model Planning Report, 12 Jan. - 4 Apr. 1987
Aaron N. Silver and William G. Cheadle Apr. 1987 82 p
(Contract N00014-85-C-0892)
(AD-A180206; MCR-87-538) Avail: NTIS HC A05/MF A01 CSCL 05C

The effort described in this report focuses upon three areas: (1) the collection of current avionics data and subsequent derivation of preliminary CER (Cost Estimating Relationship) prototypes for ultimately calibrating the SASET model parameters; (2) the categorization and organization of functional sizing data for formulating a suitable avionics data base; and (3) the calibration of the SASET model avionics data base to ensure verification and validation of all SASET model parameters. In this respect, a total review of all SASET model requirements has begun. GRA

N87-25797# Cornell Univ., Ithaca, N.Y. Mathematical Sciences Inst.
INTEGRATION CONSTRAINTS IN PARAMETRIC DESIGN OF PHYSICAL OBJECTS
Alberto Paoluzzi Jan. 1987 33 p
(Contract DAAG29-85-C-0018)

(AD-A180533; TR-87-29; TR-87-804; ARO-23306.65-MA) Avail: NTIS HC A03/MF A01 CSCL 12A

Design by constraint is a powerful approach to improve computer aided design (CAD) systems and designer productivity. This paper addresses the topic of incorporating integration constraints concerning object mass and inertia in a CAD system. Two classes of generic objects are discussed that contain affine and conformal images of a given solid, usually derived from the initial design solution. Domain-derivatives are partial derivatives needed to solve the existence problem of an object instance satisfying all constraints and, eventually, to find an optimal design solution. It is shown that these derivatives are closely linked to the topology of the solid. They are symbolically expressible as integrals over domains having a lower geometrical dimension than the original solid. GRA

N87-25798# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
A FLEXIBLE MANUFACTURING SYSTEM [FLEXIBLES FERTIGUNGSSYSTEM]
Bernd Brodbeck 1986 6 p Repr. from IBM-Nachrichten (West Germany), v. 35, Oct. 1985 p 25-29 In GERMAN
(MBB-UA-996/85; ETN-87-99921) Avail: Issuing Activity

An integrated, computer aided system of precision manufacturing is presented, as a step towards computer integrated manufacturing. The design aimed at a generality of the data in the horizontal direction (by a connection between the different manufacturing domains and steps) as well as in the vertical direction (from the beginning of the production process till series production). The materials flow and information flow in the manufacturing process are depicted. The functional structure of the manufacturing control system and its connection with other fields are presented. The computer structure of the manufacturing control system is explained. Experiences and planned improvements are mentioned. ESA

N87-25799 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
INTEGRATED CONTROL OF A FLEXIBLE MANUFACTURING SYSTEM [INTEGRIERTE STEUERUNG EINES FLEXIBLEN FERTIGUNGSSYSTEMS]
K. Hitz 1986 7 p Repr. from ZWF (Munich, West Germany), v. 81, no. 3, 1986 p 117-122 In GERMAN Presented at VDI-Seminars Flexibel Vernetzte Fertigungssysteme, Berlin, West Germany, 14-15 Nov. 1985
(MBB-UD-488/86; ETN-87-99929) Copyright Avail: Issuing Activity

A global concept which includes computer aided manufacturing, engineering, and planning is presented. The structure of a computerized, integrated, and automated engineering and manufacturing system is depicted. The basic data flow system and the materials flow system are presented. The integrated store and transport system is explained. The hardware configuration for cutting manufacturing is depicted. The reduction in piece work, time in process, and manufacturing cost is discussed. ESA

N87-25800*# Computer Sciences Corp., Hampton, Va.
ACOUSTIC SOURCE BEARING ESTIMATION (ASBE) COMPUTER PROGRAM DEVELOPMENT
Michael R. Wiese Mar. 1987 33 p
(Contract NAS1-17999)
(NASA-CR-178300; NAS 1.26:178300; TAO-50056) Avail: NTIS HC A03/MF A01 CSCL 09B

A new bearing estimation algorithm (Acoustic Source Analysis Technique - ASAT) and an acoustic analysis computer program (Acoustic Source Bearing Estimation - ASBE) are described, which were developed by Computer Sciences Corporation for NASA Langley Research Center. The ASBE program is used by the Acoustics Division/Applied Acoustics Branch and the Instrument Research Division/Electro-Mechanical Instrumentation Branch to analyze acoustic data and estimate the azimuths from which the source signals radiated. Included are the input and output from a benchmark test case. Author

N87-25801*# Control Dynamics Co., Huntsville, Ala.
CONTACT DYNAMICS MATH MODEL Interim Report
John R. Glaese and Patrick A. Tobbe Apr. 1986 95 p
(Contract NAS8-36570)
(NASA-CR-179147; NAS 1.26:179147) Avail: NTIS HC A05/MF A01 CSCL 09B

The Space Station Mechanism Test Bed consists of a hydraulically driven, computer controlled six degree of freedom (DOF) motion system with which docking, berthing, and other mechanisms can be evaluated. Measured contact forces and moments are provided to the simulation host computer to enable representation of orbital contact dynamics. This report describes the development of a generalized math model which represents the relative motion between two rigid orbiting vehicles. The model allows motion in six DOF for each body, with no vehicle size limitation. The rotational and translational equations of motion are derived. The method used to transform the forces and moments from the sensor location to the vehicles' centers of mass is also explained. Two math models of docking mechanisms, a simple translational spring and the Remote Manipulator System end effector, are presented along with simulation results. The translational spring model is used in an attempt to verify the simulation with compensated hardware in the loop results. M.G.

N87-25893*# Houston Univ., Tex. Dept. of Natural Sciences.
AN EVALUATION OF TURBO PROLOG WITH AN EMPHASIS ON ITS APPLICATION TO THE DEVELOPMENT OF EXPERT SYSTEMS
Richard B. Loftin *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 13 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 13 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N87-25802*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IMPLEMENTATION OF MULTIGRID METHODS FOR SOLVING NAVIER-STOKES EQUATIONS ON A MULTIPROCESSOR SYSTEM
Vijay K. Naik and Shlomo Taasan Jun. 1987 34 p
(Contract NAS1-18107)
(NASA-CR-178319; ICASE-87-37; NAS 1.26:178319) Avail: NTIS HC A03/MF A01 CSCL 09B

Presented are schemes for implementing multigrid algorithms on message based MIMD multiprocessor systems. To address the various issues involved, a nontrivial problem of solving the 2-D incompressible Navier-Stokes equations is considered as the model problem. Three different multigrid algorithms are considered. Results from implementing these algorithms on an Intel iPSC are presented. Author

N87-25803*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HYBRID ANALOG-DIGITAL ASSOCIATIVE NEURAL NETWORK Patent Application
Alexander W. Moopenn, inventor (to NASA), Anilkumar Thakoor, inventor (to NASA), and John J. Lambe, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 21 May 1987 20 p
(Contract NAS7-918)
(NASA-Case-NPO-17058-1-CU; US-Patent-Appl-SN-060201)
Avail: NTIS HC A02/MF A01 CSCL 09B

Random access memory is used to store synaptic information in the form of a matrix of rows and columns of binary digits. N rows read in sequence are processed through switches and

resistors, and a summing amplifier to N neural amplifiers in sequence, one row for each amplifier, using a first array of sample-and-hold devices S/H1 for commutation. The outputs of the neural amplifiers are stored in a second array of sample-and-hold devices S/H2 so that after N rows are processed, all of the second array of sample-and-hold devices are updated. A second memory may be added for binary values of 0 and -1, and processed simultaneously with the first to provide for values of 1, 0, and -1, the results of which are combined in a difference amplifier. NASA

63 CYBERNETICS

Includes feedback and control threory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N87-25804*# Connecticut Univ., Storrs. Dept. of Electrical and Systems Engineering.

DUAL ADAPTIVE CONTROL: DESIGN PRINCIPLES AND APPLICATIONS

Purusottam Mookerjee, Yaakov BarShalom, and John A. Molusis Jun. 1987 118 p

(Grant NAG2-318)

(NASA-CR-181050; NAS 1.26:181050) Avail: NTIS HC A06/MF A01 CSCL 09B

An adaptive dual control solution was developed for an ARMA MIMO system. This solution captures the dual effect by performing a second order Taylor series expansion of the expected future cost. It modifies the cautious solution by numerator and denominator correction terms. Analysis of the simulation runs has shown that this dual control solution applied to a multi-input multi-output model improves over the cautious controller. The key improvement is in the avoiding of situations like turnoff and slow convergences, typical of the cautious solution. Author

N87-25805# Massachusetts Inst. of Tech., Cambridge. Space Systems Lab.

DEVELOPMENT OF INTELLIGENT STRUCTURES USING FINITE CONTROL ELEMENTS IN A HIERARCHIC AND DISTRIBUTED CONTROL SYSTEM Final Report, 15 May 1985 - 14 Jan. 1986

David W. Miller, Benjamin A. Ward, Edward F. Crawley, and William Widnall 12 Jan. 1987 324 p

(Contract F49620-84-K-0010)

(AD-A179711; MIT-SSL-1-87; AFOSR-87-0560TR) Avail: NTIS HC A14/MF A01 CSCL 22B

Conclusions are drawn from the theoretical optimization of inertial reaction devices. Three different optimization procedures yielded almost identical absorber designs providing confidence in the tuning process. The optimal passive components of the control actuator were found to be equal to those of the optimal absorber. This allows passive damping to be added without significant mass penalty. When using an inertial device to increase damping in several modes, it is desirable to tune the frequency of the device to the lowest mode and adjust the damping accordingly. Experimentally, an inertial reaction device was used effectively as both a passive vibration absorber and a control actuator, passively tuned as an absorber, verifying the results of the tuning analysis that stated that passive tuning compliments active control. This dual purpose device resulted in a mass savings, increased modal controllability, and reduced target mode disturbance transmission. Additional passive damping increases gain margin for feedback systems that are conditionally stable and allows a form of passive damping enhancement in the event of control system failure. These space realizable experiments were found to be important in determining performance limitations due to instrumentation instabilities, friction in relative motion actuators, and actuator saturation at low frequencies. Uniformity in the positive definite, dual feedback matrix allowed better performance before the onset of instrumentation. GRA

N87-25806*# Information and Control Systems, Inc., Hampton, Va.

A COMBINED STOCHASTIC FEEDFORWARD AND FEEDBACK CONTROL DESIGN METHODOLOGY WITH APPLICATION TO AUTOLAND DESIGN Final Report

Nesim Halyo Washington NASA Jul. 1987 130 p

(Contract NAS1-16158)

(NASA-CR-4078; NAS 1.26:4078; FR-687102) Avail: NTIS HC A07/MF A01 CSCL 09B

A combined stochastic feedforward and feedback control design methodology was developed. The objective of the feedforward control law is to track the commanded trajectory, whereas the feedback control law tries to maintain the plant state near the desired trajectory in the presence of disturbances and uncertainties about the plant. The feedforward control law design is formulated as a stochastic optimization problem and is embedded into the stochastic output feedback problem where the plant contains unstable and uncontrollable modes. An algorithm to compute the optimal feedforward is developed. In this approach, the use of error integral feedback, dynamic compensation, control rate command structures are an integral part of the methodology. An incremental implementation is recommended. Results on the eigenvalues of the implemented versus designed control laws are presented. The stochastic feedforward/feedback control methodology is used to design a digital automatic landing system for the ATOPS Research Vehicle, a Boeing 737-100 aircraft. The system control modes include localizer and glideslope capture and track, and flare to touchdown. Results of a detailed nonlinear simulation of the digital control laws, actuator systems, and aircraft aerodynamics are presented. Author

N87-25807*# Purdue Univ., West Lafayette, Ind. School of Aeronautics and Astronautics.

OPTIMAL COOPERATIVE CONTROL SYNTHESIS OF ACTIVE DISPLAYS Final Contractor Report

Sanjay Gary and David K. Schmidt Washington NASA Jun. 1987 169 p

(Grant NAG2-228)

(NASA-CR-4058; H-1378; NAS 1.26:4058) Avail: NTIS HC A08/MF A01 CSCL 09B

A technique is developed that is intended to provide a systematic approach to synthesizing display augmentation for optimal manual control in complex, closed-loop tasks. A cooperative control synthesis technique, previously developed to design pilot-optimal control augmentation for the plant, is extended to incorporate the simultaneous design of performance enhancing displays. The technique utilizes an optimal control model of the man in the loop. It is applied to the design of a quickening control law for a display and a simple K/(s squared) plant, and then to an F-15 type aircraft in a multichannel task. Utilizing the closed-loop modeling and analysis procedures, the results from the display design algorithm are evaluated and an analytical validation is performed. Experimental validation is recommended for future efforts. Author

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N87-25808# Yale Univ., New Haven, Conn. Dept. of Computer Science.

SOLVING SCHROEDINGER'S EQUATION OF THE INTEL IPSC BY THE ALTERNATING DIRECTION METHOD

Faisal Saied, Ching-Tien Ho, S. L. Johnson, and Martin H. Schultz Jan. 1987 15 p

(Contracts N00014-84-K-0043; N00014-86-K-0564; Grants NSF DCR-81-06181; DAAL03-86-G-0029)

(AD-A179793; YALEU/DCS/TR-502) Avail: NTIS HC A02/MF A01 CSCL 12A

This document considers the numerical solution of the Schroedinger's equation and investigates several different

algorithms for implementing the Alternating Direction Method on hypercubes. The author indicates the relative merits of the algorithms depending on cube parameters such as arithmetic speed, communication latency, transfer rate, the packet size, and the cost of reordering data locally. Presented are timings for the Intel iPSC that show that Alternating Direction Methods can be implemented efficiently on hypercubes. GRA

N87-25809# State Univ. of New York, Buffalo.
EFFICIENT COMPLEX MATRIX MULTIPLICATION Final Technical Report, Dec. 1985 - Jan. 1987
Adly T. Fam Mar. 1987 10 p
(Contract F30602-81-C-0185)
(AD-A179861; RADC-NP-87-3) Avail: NTIS HC A02/MF A01 CSCL 12A

A well known algorithm for complex multiplication which requires three real multiplications and five real additions is observed not to require commutativity. This extends its applicability to complex matrices as examined in this report. The computational savings are shown to approach 1/4, even if a real multiplication is not more computationally costly than a real addition. The computational cost function used is based on the number of equivalent real additions, with every real multiplication counted as equivalent to real additions. Author (GRA)

N87-25810# Titan Systems, Inc., La Jolla, Calif.
ADDRESSING THE TRAVELLING SALESMAN PROBLEM THROUGH EVOLUTIONARY ADAPTATION Interim Report, Apr. - Jul. 1986
David B. Fogel Jan. 1987 38 p Sponsored by Dept. of the Army
(AD-A179992; ARI-RN-87-04) Avail: NTIS HC A03/MF A01 CSCL 12A

The optimization of the traveling salesman problem continues to receive attention for three reasons: (1) its solution is computationally difficult although the algorithm itself is easily expressed; (2) it is broadly applicable to a variety of engineering problems; and (3) it has become somewhat of a comparison benchmark problem. The task is to arrange a tour of n cities such that each city is visited only once and the length of the tour (or some other cost function) is minimized. For an exact solution the only known algorithms require the number of steps to grow at least exponentially with the number of elements in the program. Brute force methods of finding of the shortest path by which a traveling salesman can complete a tour of n cities require compiling a list of (n-1) alternative tours, a number that grows faster than any finite power of n. The task quickly becomes unmanageable. GRA

N87-25811# California Inst. of Tech., Pasadena.
LATTICE GAUGE THEORY ON A PARALLEL COMPUTER Ph.D. Thesis
J. W. Flower 1987 192 p
(Contract DE-FG03-85ER-25009)
(DE87-008771; DOE/ER-25009/411) Avail: NTIS HC A09/MF A01

The results of several numerical simulations of QCD by Monte Carlo lattice gauge theory are presented. Studying the mesonic potential on a 20 sup 4 lattice, we conclude that asymptotic scaling does not hold over the range 6.1 less than or equal to Beta less than or equal to 6.7, although we are not able to quantify the discrepancies. The effect of discrete rotational symmetry on physical parameters is examined and seems to modify the string tension by 15% at Beta = 6.1, while at Beta = 6.3 the change was less than 1%. The potential between three charges is studied and yields a string tension of .18 GeV sq., consistent with mesonic calculations and relativized potential models. Contributions to the potential from low-energy string vibrations appear small in the range x less than or equal to .5 fm. We perform energy density measurements in the color fields surrounding both mesons and baryons, which provide strong evidence in favor of the dual superconductor picture of confinement. It is also suggested that the confining strings in the baryon meet at a central point rather than joining the quarks pairwise. Several algorithms are explored in an attempt to develop simulation methods which are able to directly account for the currents generated by color sources. The extension of the Langevin equation to complex degrees of freedom is derived leading to a Fokker-Planck equation for a complex Probability distribution. Using this technique we are then able to calculate energy densities in U(1) gauge theory at large charge separations. DOE

N87-25812*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ERROR ANALYSIS FOR SPECTRAL APPROXIMATION OF THE KORTEWEG-DE VRIES EQUATION Final Report
Y. Maday and A. Quarteroni (Universita Cattolica, Brescia, Italy) Jun. 1987 27 p Submitted for publication
(Contract NAS1-18107)
(NASA-CR-178317; NAS 1.26:178317; ICASE-87-36) Avail: NTIS HC A03/MF A01 CSCL 12A

The conservation and convergence properties of spectral Fourier methods for the numerical approximation of the Korteweg-de Vries equation are analyzed. It is proved that the (aliased) collocation pseudospectral method enjoys the same convergence properties as the spectral Galerkin method, which is less effective from the computational point of view. This result provides a precise mathematical answer to a question raised by several authors in recent years. Author

N87-25813*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
APPROXIMATING THE LINEAR QUADRATIC OPTIMAL CONTROL LAW FOR HEREDITARY SYSTEMS WITH DELAYS IN THE CONTROL
Mark H. Milman 15 Mar. 1987 70 p
(Contract NAS7-918)
(NASA-CR-181161; JPL-Pub-87-6; NAS 1.26:181161) Avail: NTIS HC A04/MF A01 CSCL 12A

The fundamental control synthesis issue of establishing a priori convergence rates of approximation schemes for feedback controllers for a class of distributed parameter systems is addressed within the context of hereditary systems. Specifically, a factorization approach is presented for deriving approximations to the optimal feedback gains for the linear regulator-quadratic cost problem associated with time-varying functional differential equations with control delays. The approach is based on a discretization of the state penalty which leads to a simple structure for the feedback control law. General properties of the Volterra factors of Hilbert-Schmidt operators are then used to obtain convergence results for the controls, trajectories and feedback kernels. Two algorithms are derived from the basic approximation scheme, including a fast algorithm, in the time-invariant case. A numerical example is also considered. Author

N87-25987# Wyle Labs., Inc., Huntsville, Ala.
ON INTEGRATING A LOGARITHMIC OR SEMILOGARITHMIC PIECEWISE LINEAR PSD PLOT OF A RANDOM VARIABLE X(T), PART 2
R. E. Doyle *In* Vibration Inst., The Shock and Vibration Digest, Volume 19, No. 7 Jul. 1987 p 3-12 (For primary document see N87-25986 19-99)
Avail: NTIS HC A05/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

No abstracts in this category.

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N87-25814# Chicago Univ., Ill. Center for Decision Research.
A THEORY OF DIAGNOSTIC INFERENCE Progress Report, 15 Oct. 1983 - 14 Feb. 1 987
Hillel J. Einhorn and Robin N. Hogarth Apr. 1987 29 p
(Contract N00014-84-C-0018)
(AD-A179786; PR-19) Avail: NTIS HC A03/MF A01 CSCL 05H

This report summarizes a program of research on diagnostic inference for the period from October 15, 1983 to February 14, 1987. The central theme underlying the work is that complex judgments and choices result from simple psychological processes that interact with highly variable and complex environments. Thus, attempts have been made to identify such processes, to describe them by parsimonious mathematical models, and to test the implications of the models in experimental strategies. Four major projects are described. These involve models of judgments of probable cause, belief updating, judgment and choice under ambiguity, and a theory of preference reversals. Discussion of each of the four projects follows the same format: statement of issues motivating the particular topic as well as principles underlying the approach adopted in the research, description of the model, summary of implications and major empirical results obtained to date. The report concludes by listing technical reports and publications which were produced during the contract period and which provide detailed information on all the projects. GRA

N87-25815# Air Command and Staff Coll., Maxwell AFB, Ala.
MILITARY MAN IN SPACE: A HISTORY OF AIR FORCE EFFORTS TO FIND A MANNED SPACE MISSION Student Report, 1945 - 1987
Timothy D. Killebrew Feb. 1987 77 p
(AD-A179873; ACSC-87-1425) Avail: NTIS HC A05/MF A01 CSCL 12B

This report traces the Air Force's efforts to find a manned military space role. It begins with the development of Dyna Soar shortly after World War II. The author traces Dyna Soar's evolution and political problems that caused its eventual cancellation and discusses the Manned Orbiting Laboratory from its beginnings in 1963 until its cancellation in 1969. He also gives the potential uses of the Manned Orbiting Laboratory and the reasons behind its cancellation. The beginnings of the Space Transportation System and the reasons behind the Air Force's decision to use STS as the sole means of entering space are traced. The study concludes with a short discussion on the future of Air Force manned space efforts including a follow-on to the Space Shuttle and the probability of a space station. GRA

N87-25816*# Martin Marietta Aerospace, Denver, Colo.
SATELLITE OPERATIONS SUPPORT EXPERT SYSTEM Final Report
13 May 1985 91 p
(Contract NAS5-28038)
(NASA-CR-180709; NAS 1.26:180709; MCR-85-594) Avail: NTIS HC A05/MF A01 CSCL 12B

The Satellite Operations Support Expert System is an effort to identify aspects of satellite ground support activity which could profitably be automated with artificial intelligence (AI) and to develop a feasibility demonstration for the automation of one such area. The hydrazine propulsion subsystems (HPS) of the International Sun Earth Explorer (ISEE) and the International Ultraviolet Explorer (IUS) were used as applications domains. A demonstration fault handling system was built. The system was written in Franz Lisp and is currently hosted on a VAX 11/750-11/780 family machine. The system allows the user to select which HPS (either from ISEE or IUE) is used. Then the user chooses the fault desired for the run. The demonstration system generates telemetry corresponding to the particular fault. The completely separate fault handling module then uses this telemetry to determine what and where the fault is and how to work around it. Graphics are used to depict the structure of the HPS, and the telemetry values displayed on the screen are continually updated. The capabilities of this system and its development cycle are described. B.G.

N87-25817# Army War Coll., Carlisle Barracks, Pa.
DETERRENCE ENHANCED BY SDI (STRATEGIC DEFENSE INITIATIVE)
Peter T. Sowa 23 Mar. 1987 46 p
(AD-A180466) Avail: NTIS HC A03/MF A01 CSCL 15C

The Strategic Defense Initiative (SDI) is an investigation by scientists, military leaders, and technologists of the feasibility of strategic defenses against ballistic missiles. Whether strategic defense is the way to go in the future remains to be seen. Although the capability of the envisioned layered, ground and space-based defensive systems is not specifically addressed, the SDI research program's affect on national security strategy and its formulation is examined. If found to be feasible and cost-effective, SDI will require a drastic change in our military strategy. This essay reviews how that strategy was formulated in the past in terms of a model and how strategic defense strategy would be used in the future. More importantly, a discussion of how the SDI impacts on present US national strategy and enhances deterrence is presented. Its influence on technology, conventional defense, and arms controls are offered on this evolving strategic concept and the renewed vigor and interest it has provided in strategy formulation. GRA

N87-25818# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
PROTECTION AGAINST AIR ATTACK THREAT [DIE ABWEHR DER LUFTRAUMBEDROHUNG]
Karl-Heinz Allgaeier 1986 5 p Repr. from Webrtech., (West Germany), v. 18 Jg., Jul. 1986 p 38-41 In GERMAN
(MBB-Z-75/86; ETN-87-99974) Avail: Issuing Activity

The significance of a defense system against attack from upper near-Earth space, and against ballistic short and medium missiles, is discussed. The characteristics of the threat and of the answer to it are presented. The problems involved in sensor systems are discussed. Air-supported defense, defense capacity against missiles, and the strengthening of conventional defense systems are discussed. ESA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N87-25819# Aerodyne Research, Inc., Billerica, Mass.
STUDY OF SUBMICRON PARTICLE SIZE DISTRIBUTION BY LASER DOPPLER MEASUREMENT OF BROWNIAN MOTION Final Report, 1 Sep. 1983 - 30 Sep. 1986
Wai K. Cheng, Keith E. McCurdy, Sarah Kostic, and Joda Wormhoudt 30 Jan. 1987 93 p
(Contract F49620-83-C-0154)
(AD-A179779; ARI-RR-563; AFOSR-87-0566TR) Avail: NTIS HC A05/MF A01 CSCL 20F

A theoretical and experimental study on the feasibility of determining the size of a single submicron particle by observing its Brownian motion characteristics has been carried out. The method is based on measurement of the particle motion

interferometrically using the light scattered from a pair of intersecting laser beams. The particle is assumed to be in thermal equilibrium with a fluid medium. Due to the viscous damping of the fluid, the motion of the particle exhibits relaxation behavior. The relaxation time may be obtained from the interference signal. Knowing the temperature and the viscosity of the fluid, the mass, hence the size of the particle may be determined from the relaxation time. Monte Carlo simulation of the Brownian motion detector response has shown that the relaxation time may be obtained from the statistics of the time between extrema of the signal. A proof-of-concept experiment was conducted using latex spheres of known sizes as test particles. The signal to noise ratio of the experimental setup, however, was not adequate for determining the size of the particles. GRA

N87-25820# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.
PREPARATION AND PROPERTIES OF ARRAYS OF VERY SMALL MAGNETIC PARTICLES Final Report, 1 Jan. 1984 - 31 Dec. 1986
C. D. Graham, Jr. and Forrest Kaatz 1 Mar. 1987 4 p
(Grant DAAG29-83-G-0104)
(AD-A179781; ARO-20361.1-MS-F) Avail: NTIS HC A02/MF A01 CSCL 20C

Techniques were developed to produce two dimensional arrays of magnetic particles with minimum dimensions of about 2500 A, to measure their magnetic properties. The purpose of the work was to provide a clean experimental test of the behavior of magnetic particles in the single domain size range, especially of the effects of particle interactions in this size range. The particles produced were too large to show single domain behavior, but with improved electron beam lithography equipment it should be possible to produce arrays of smaller particles. An improved vibrating sample magnetometer was developed to permit measurement of the magnetic properties of these very small samples. GRA

N87-25821*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A FINITE ELEMENT MODEL FOR WAVE PROPAGATION IN AN INHOMOGENEOUS MATERIAL INCLUDING EXPERIMENTAL VALIDATION
Kenneth J. Baumeister and Milo D. Dahl 1987 15 p Prepared for presentation at the 11th Aerocoustics Conference, Sunnyvale, Calif., 19-21 Oct. 1987; sponsored by AIAA
(NASA-TM-100149; E-3471; NAS 1.15:100149) Avail: NTIS HC A02/MF A01 CSCL 20C

A finite element model was developed to solve for the acoustic pressure field in a nonhomogeneous region. The derivations from the governing equations assumed that the material properties could vary with position resulting in a nonhomogeneous variable property two-dimensional wave equation. This eliminated the necessity of finding the boundary conditions between the different materials. For a two media region consisting of part air (in the duct) and part bulk absorber (in the wall), a model was used to describe the bulk absorber properties in two directions. An experiment to verify the numerical theory was conducted in a rectangular duct with no flow and absorbing material mounted on one wall. Changes in the sound field, consisting of planar waves was measured on the wall opposite the absorbing material. As a function of distance along the duct, fairly good agreement was found in the standing wave pattern upstream of the absorber and in the decay of pressure level opposite the absorber. Author

N87-25822*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEPOLARIZATION MEASUREMENT METHOD AND DEVICE Patent Application
Jose M. Alvarez, inventor (to NASA) 18 Jun. 1987 16 p
(NASA-Case-LAR-13621-1; US-Patent-Appl-SN-063354) Avail: NTIS HC A02/MF A01 CSCL 20C

This invention relates to a depolarization measurement method and device which employs a rotatably mounted half-wave plate to introduce a small amount of radiation from a parallel component into a perpendicular component of the depolarization device by rotating a half-wave plate by a predetermined small angle. The ratio of the outputs of a detection means, which detects the light in the parallel and perpendicular channels, is determined and a gain ratio and depolarization ratio of the detection means are simultaneously determined. The accuracy of field measurements are improved by eliminating the requirment that the depolarization device be previously calibrated at every gain possible. In addition, the device is simple to use and less time-consuming. NASA

N87-25823*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENHANCED THERMAL EMITTANCE OF SPACE RADIATORS BY ION-DISCHARGE CHAMBER TEXTURING
Michael J. Mirtich and Michael T. Kussmaul (Cleveland State Univ., Ohio.) 1987 14 p Presented at the International Conference on Metallurgical Coatings, San Diego, Calif. 23-27 Mar. 1987; sponsored by the American Vacuum Society
(NASA-TM-100137; E-3687; NAS 1.15:100137) Avail: NTIS HC A02/MF A01 CSCL 20C

The discharge chamber of a 30-cm argon ion source was successfully used to texture potential space radiator materials for the purpose of obtaining values of thermal emittance greater than 0.85 at 700 and 900 K. Some samples were also treated in acid prior to texturing. To evaluate the durability of the textured materials to atomic oxygen, samples were exposed to an RF air plasma environment. The spectral emittance between 2.0 anf 15.0 microns was measured before and after the textured materials were exposed to the plasma asher. The results indicate that copper with extremely high values of emittance after texturing (0.978 and 0.983) at 700 and 900 K, respectively,did not change its values of emittance after ashing, whereas the emittance of stainless steel fell below 0.85 after ashing. These data, along with scanning electron photomicrographs, and the results of texturing and ashing titanium and Nb(1)Zr are presented . Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution.*

N87-25824# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
MEASUREMENT OF NOISE FROM AIRPLANES TRAVELING AT 3500 TO 11000 M ALTITUDE
Magnus Linde and Staffan Meijer Mar. 1986 34 p Sponsored by the Swedish National Board for Technical Development
(FFA-TN-1986-21; ETN-87-99779) Avail: NTIS HC A03/MF A01

The noise on the ground from jet and propeller airplanes at heights 3500 to 11000 m was measured. Results are presented as dBA-levels versus flight level. Equivalent noise levels were also calculated. Examples are given for how increased noise generation from airplanes affects the resulting Flight Noise Level (a Swedish noise rating for noise exposure forecast). It is found that Flight Noise Level 55 dBA can easily be exceeded if it is assumed that a certain number of the flights is made with airplanes giving higher equivalent noise level. ESA

N87-25825# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
HARPO: A VERSATILE THREE-DIMENSIONAL HAMILTONIAN RAY-TRACING PROGRAM FOR ACOUSTIC WAVES IN AN OCEAN WITH IRREGULAR BOTTOM
R. M. Jones, J. P. Riley, and T. M. Georges Oct. 1986 468 p
(PB87-172573) Avail: NTIS HC A20/MF A01 CSCL 20A

HARPO stands for Hamiltonian Acoustic Ray-tracing Program for the Ocean. The FORTRAN computer program traces the three-dimensional paths of acoustic rays through model oceans by numerically integrating Hamilton's equations, which are a differential expression of Fermat's principles. The user specifies

an ocean model by writing closed-form formulas for its three-dimensional current and sound-speed distribution, and by defining the depth of the bottom as a function of geographic latitude and longitude. Some general-purpose models are provided, or users can easily design their own. The ray-tracing equations and the structure of the program are described and complete instructions for using it are provided, illustrated by a sample case. The program is modular and can be adapted to model propagation through other media by changing the routine that defines the medium's dispersion relation. GRA

N87-25826*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF FIBER MOTION ON THE ACOUSTIC BEHAVIOR OF AN ANISOTROPIC, FLEXIBLE FIBROUS MATERIAL

Milo D. Dahl, Edward J. Rice, and Donald E. Groesbeck May 1987 33 p Presented at the 113th Meeting of the Acoustical Society of America, Indianapolis, Ind., 11-16 May 1987
(NASA-TM-89884; E-3568; NAS 1.15:89884) Avail: NTIS HC A03/MF A01 CSCL 20A

The acoustic behavior of a flexible fibrous material was studied experimentally. The material consisted of cylindrically shaped fibers arranged in a batting with the fibers primarily aligned parallel to the face of the batting. This type of material was considered anisotropic, with the acoustic propagation constant depending on whether the dirction of sound propagation was parallel or normal to the fiber arrangement. Normal incidence sound absorption measurements were taken for both fiber orientations over the frequency range 140 to 1500 Hz and with bulk densities ranging from 4.6 to 67 kg/cu m. When the sound propagated in a direction normal to the fiber alignment, the measured sound absorption showed the occurrence of a strong resonance, which increased absorption above that attributed to viscous and thermal effects. When the sound propagated in a direction parallel to the fiber alignment, indications of strong resonances in the data were not present. The resonance in the data for fibers normal to the direction of sound propagation is attributed to fiber motion. An analytical model was developed for the acoustic behavior of the material displaying the same fiber motion characteristics shown in the measurements. Author

N87-25827*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EFFECT OF SIGNAL JITTER ON THE SPECTRUM OF ROTOR IMPULSIVE NOISE

Thomas F. Brooks Jun. 1987 18 p Submitted for publication
(NASA-TM-100477; NAS 1.15:100477) Avail: NTIS HC A02/MF A01 CSCL 20A

The effect of randomness or jitter of the acoustic waveform on the spectrum of rotor impulsive noise is studied because of its importance for data interpretation. An acoustic waveform train is modelled representing rotor impulsive noise. The amplitude, shape, and period between occurrences of individual pulses are allowed to be randomized assuming normal probability distributions. Results, in terms of the standard deviations of the variable quantities, are given for the autospectrum as well as special processed spectra designed to separate harmonic and broadband rotor noise components. Consideration is given to the effect of accuracy in triggering or keying to a rotor one per revolution signal. An example is given showing the resultant spectral smearing at the high frequencies due to the pulse signal period variability. Author

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N87-25828# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

VIBRATIONAL EXCITATION IN THE CHARGE EXCHANGE BETWEEN PROTONS AND MOLECULES [SCHWINGUNGSANREGUNG BEIM LADUNGSAUSTAUSCH VON PROTONEN MIT MOLEKUELEN]

M. Noll Jun. 1986 231 p Partly in GERMAN and ENGLISH
(MPIS-8/1986; ISSN-0436-1199; ETN-87-99707) Avail: NTIS HC A11/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 42

The scattering of H(+)- and He(+)-ions on two and polyatomic molecules was investigated at energies in the range of 20eV. For the rotation, examples show that the excitation can be explained by implusive collisions between ions and single atoms of the molecule. For vibrational excitation by proton collisions, charge exchange and electrostatic forces occur, accompanied by high energy transfers. Characteristic examples of the electrostatic mechanism are the systems H(+)-CHF3, CF4, SF6, (high ionization energies) the results of which lead to an improved understanding of molecular vibrational excitation induced by multipole interaction. For the other investigated molecules (CO, O2, CH4, C2H4, C2H6) there exists a high probability of charge exchange in collisions with protons. ESA

N87-25829*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AN ION GENERATOR AND ION APPLICATION SYSTEM Patent Application

A. P. Biddle, inventor (to NASA) 3 Mar. 1987 16 p
(NASA-Case-MFS-28122-1; US-Patent-Appl-SN-021100) Avail: NTIS HC A02/MF A01 CSCL 20H

A vacuum chamber within which an instrument to be calibrated or tested is placed, is fitted with an ion gun having an ion source. The source has an electron emitting filament positioned adjacent to one end of an ionization chamber, with a negatively biased grid located behind the filament. Gas is injected into the source by a gas flow regulator in one end of the source. The chamber is surrounded by a plurality of independently energizable coils, with the last coil being operated at the highest current level, thus producing the highest magnetic flux. This presents a region of magnetic repulsion to the electrons produced by the filament and causes them to be confined between the grid and the region, greatly increasing the chances that an ionization collision will occur between the electrons and atoms of the injected gas. Ions are extracted from the ionization chamber by a negatively biased extractor grid positioned adjacent to an opposite end of the chamber and are collimated by a negatively biased shield grid positioned adjacent to the extractor grid. NASA

N87-25830*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.

THE PRODUCTION OF O(1D) FROM DISSOCIATIVE RECOMBINATION OF O2(+)

Steven L. Guberman 1987 23 p
(Contract NCC2-308; Grants NSF ATM-86-16776; AF-AFOSR-0109-84)
(NASA-CR-191145; NAS 1.26:191145) Avail: NTIS HC A02/MF A01 CSCL 20H

The results of large scale ab initio calculations of the rates for production of O(1D) by dissociative combination of O2(+) are presented for electron temperatures in the range 100 to 3000 K. A 1-delta-u state is the dominant dissociative route from v = 0 and a 3-sigma-u(-) state is the most important route from v = 1 and v = 2. The calculated total rate for O(1D) production from v = 0 is 2.21(+0.21,-0.24) x 10(-7) x (T sub e/300) exp -.46 near room temperature. The v = 1 and v = 2 rates are about 17% and 47% smaller respectively, than the v = 0 rate at 300 K. Author

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N87-25831# Southeastern Univ. Research Association, Newport News, Va. Continuous Electron Beam Accelerator Facility.
SUMMARY SESSION OF THE PANIC '87 CONFERENCE, 11TH INTERNATIONAL CONFERENCE ON PARTICLES AND NUCLEI
J. D. Walecka 1987 14 p Conference held in Kyoto, Japan, 20-24 Apr. 1987
(Contract DE-AC05-84ER-40150)
(CEBAF-PR-87-020) Avail: NTIS HC A02/MF A01

The present state of experimental nuclear physics is reviewed and the current goals of accelerator studies at the Continuous Electron Beam Accelerator Facility (CEBAF) are described. Emphasis is given to electromagnetic interactions, particularly electron scattering. M.G.

N87-25832# Southeastern Univ. Research Association, Newport News, Va.
CURRENT CONSERVATION AND INTERACTION CURRENTS IN RELATIVISTIC MESON THEORIES
Franz Gross and D. O. Riska (Helsinki Univ., Finland) 1987 48 p
(Contract DE-AC05-84ER-40150)
(CEBAF-PR-87-022) Avail: NTIS HC A03/MF A01

The relation between the nucleon-nucleon interaction and exchange currents needed for current conservation are derived for the Bethe-Salpeter formalism, and for the approach in which the spectator particle is restricted to its mass shell. For both approaches, it is shown how to achieve current conservation for a completely general isospin dependent, energy dependent interaction with arbitrary phenomenological electromagnetic form factors for the nucleon and mesons, and with strong form factors at the meson-nucleon vertices. Contrary to what has often been stated in the literature, the development shows that current conservation places no restrictions on the use of different electromagnetic form factors for mesons and nucleons, and that phenomenological meson-nucleon form factors can be introduced in a way which is consistent with current conservation. The longitudinal part of the exchange current is uniquely determined by current conservation, and for the common case of an interaction that only depends on the invariant momentum transfer variable an explicit expression for this longitudinal exchange current is given. The transverse part, which contains all electromagnetic form factors, is unconstrained by current conservation. M.G.

N87-25833# Southeastern Univ. Research Association, Newport News, Va. Continuous Electron Beam Accelerator Facility.
SUPERCONDUCTING RADIO FREQUENCY TECHNOLOGY: EXPANDING THE HORIZONS OF PHYSICS AND TECHNOLOGY
H. A. Grunder, C. W. Leemann, R. M. Sundelin, and B. K. Hartline 1987 16 p
(Contract DE-AC05-84ER-40150)
(CEBAF-PR-87-023) Avail: NTIS HC A02/MF A01

Superconducting radio frequency (SRF) accelerating structures promise low rf losses and high gradients under continuous wave operation. High-quality, intense continuous wave beams can be accelerated without risk of melting the structure and without requiring enormous amounts of input rf power. The intrinsically low losses make SRF technology attractive for high-energy electron-positron storage rings and colliders, TeV-scale electron-positron linear colliders, free electron laser drivers, and all types of cw linacs. Progress in SRF technology is reviewed and some present and proposed SRF accelerator projects are described. Cryogenic temperature optimization is also briefly discussed. M.G.

N87-25834# Southeastern Univ. Research Association, Newport News, Va. Continuous Electron Beam Accelerator Facility.
CORRELATIONS AND BEAM NOISE
Joseph J. Bisognano 1987 27 p Submitted for publication
(Contract DE-AC05-84ER-40150)
(CEBAF-PR-87-21) Avail: NTIS HC A03/MF A01

The time-varying currents generated by a particle beam in a storage ring produce rf electromagnetic fields which can be intercepted by a pickup structure for beam diagnostics. The temporal variation of the current has several sources: macroscopic bunching, collective oscillations, and the underlying discrete nature of a particle beam. This discreteness at the microscopic level provides the high frequency structure necessary for the production of Schottky noise. It is not, however, the discreteness alone, but rather the combination of discreteness and randomness in position of the particles relative to each other that is responsible for the typical spectral character of the noise. If this randomness is not complete (i.e., if the particle positions are correlated) the rf signal can be significantly modified and as a function of frequency can be enhanced or suppressed. A heuristic view of the nature of these correlations is presented which stresses generality to most long-range particle interactions of moderate strength. The effects of correlation phenomena on Schottky noise are examined. M.G.

N87-25835# Naval Research Lab., Washington, D. C. Plasma Theory Branch.
EFFECTS OF RADIATION DAMPING ON BEAM QUALITY IN THE INVERSE FREE ELECTRON LASER ACCELERATOR Interim Report
Antonio C. Ting (Berkeley Scholars, Inc., Calif.) and Phillip A. Sprangle 7 Apr. 1987 30 p
(Contract DE-AI05-83ER-40117)
(AD-A180035; NRL-MR-5819) Avail: NTIS HC A03/MF A01 CSCL 09C

The effect synchrotron radiation damping has on the transverse beam emittance for an inverse electron laser (IFEL) accelerator is studied. A beam envelope equation is derived and solved for an arbitrarily tapered wiggler field. The expression for the evolution of the normalized transverse beam emittance is derived and found to decrease exponentially with distance due to radiation damping, until it is limited by quantum excitation. The beam envelope equation is integrated both analytically and numerically for a set of IFEL accelerator parameters. Our results show that for acceleration distances comparable to the radiation damping e-folding length, substantial improvements in the beam quality can be realized. GRA

N87-25836# Sandia National Labs., Albuquerque, N. Mex.
THERMAL CONTROL OF SPACE X-RAY EXPERIMENT
R. L. Akau and D. W. Larson 8 Jun. 1987 18 p Presented at the 22nd AIAA Thermophysics Conference, Honolulu, Hawaii, 8 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-008515; SAND-86-2588C; CONF-870623-3) Avail: NTIS HC A02/MF A01

A thermal control system has been designed for the Uniformly Redundant Array (URA), which is a shuttle-launched scientific experiment to detect and map X-ray sources in space. Tasks included the design, development, installation, and testing of the thermal control system for the experiment. The URA thermal control system must assure that the various components of the experiment survive and remain within operational temperature limits when exposed to temperature extremes of space resulting from different shuttle orientations. A thermal model was developed to simulate different orbital configurations and thermal-vacuum tests were conducted to test the reliability of the thermal hardware, and verify the thermal model. The tests and analyses indicated that the thermal control system was able to meet the design goals. DOE

N87-25837# Technische Univ., Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
CONTRIBUTIONS TO THE DISPOSAL OF HIGHLY RADIOACTIVE REACTOR WASTES IN SPACE Ph.D. Thesis [BEITRAEGE ZUR LAGERUNG HOCHRADIOAKTIVER REAKTORABFAELLE IM WELTRAUM]
Erwin Promoli 1985 193 p In GERMAN
(ETN-87-99343) Avail: NTIS HC A09

A specific cost function of nuclear wastes disposal in space was deduced using payload models for the upper Earth orbits. An engineering estimate shows that the allowed temperatures in compact disposals of several million tons, consisting of single containers, are not exceeded. The investigation of the natural attitude stability shows that a stable attitude can easily be maintained. It is found that for heights above 500 km, the orbit life expectation exceeds that of the Earth. For lower heights, an attitude hold is feasible by a constant propulsion with the lowest thrust. For the lowest orbits the costs are too high. The cost-optimized height is in the range of 500 km. Comparison between the risks of the disposal on Earth and in space shows that the global risk of both variants is comparable, due to the complementary risks on Earth, such as reprocessing, recovery, etc. ESA

N87-25838*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUCLEAR REACTOR POWER FOR A SPACE-BASED RADAR. SP-100 PROJECT
Harvey Bloomfield, Jack Heller, Leonard Jaffe, Richard Beatty, Pradeep Bhandari, Edwin Chow, William Deininger, Richard Ewell, Toshio Fujita, Merlin Grossman et al. 31 Aug. 1986 176 p Prepared in cooperation with JPL, Pasadena, Calif. and Los Alamos National Lab., N. Mex.
(Contracts NAS7-918; DE-AI03-86SF-16013)
(NASA-TM-89295; JPL-Pub-86-47; NAS 1.15:89295) Avail: NTIS HC A09/MF A01 CSCL 18I

A space-based radar mission and spacecraft, using a 300 kWe nuclear reactor power system, has been examined, with emphasis on aspects affecting the power system. The radar antenna is a horizontal planar array, 32 X 64 m. The orbit is at 61 deg, 1088 km. The mass of the antenna with support structure is 42,000 kg; of the nuclear reactor power system, 8,300 kg; of the whole spacecraft about 51,000 kg, necessitating multiple launches and orbital assembly. The assembly orbit is at 57 deg, 400 km, high enough to provide the orbital lifetime needed for orbital assembly. The selected scenario uses six Shuttle launches to bring the spacecraft and a Centaur G upper-stage vehicle to assembly orbit. After assembly, the Centaur places the spacecraft in operational orbit, where it is deployed on radio command, the power system started, and the spacecraft becomes operational. Electric propulsion is an alternative and allows deployment in assembly orbit, but introduces a question of nuclear safety. Author

74 OPTICS

Includes light phenomena; and optical devices.
For lasers see *36 Lasers and Masers.*

N87-25839# GTE Labs., Inc., Waltham, Mass.
SUPERLUMINESCENT LED (SLED) STUDY Final Report, Jun. 1984 - Dec. 1985
Robert Olshansky Nov. 1986 22 p
(Contract F19628-84-C-0015)
(AD-A179829; RADC-TR-86-101) Avail: NTIS HC A02/MF A01 CSCL 13A

This is the final report for a contract to develop superluminescent LEDs (SLEDs) for use with graded-index multimode fibers. The basic technical objective is to develop a SLED which can couple at least 500 micro W to power into a standard 0.20 NA 50-um core graded-index fiber at a drive current not exceeding 200 milli A. The program objectives have been met and exceeded. Three devices mounted in a standard package with thermo-electric cooler (TEC) and graded-index fiber pigtail have been shipped to the customer. GRA

N87-25840# Sea Tech, Inc., Corvallis, Oreg.
DEVELOPMENT OF AN OPTICAL FEEDBACK BASED HIGH ACCURACY BEAM TRANSMISSOMETER Progress Report
Richard W. Spinrad 1 Apr. 1987 4 p
(Contract N00014-86-C-0784)
(AD-A179978) Avail: NTIS HC A02/MF A01 CSCL 09E

The technical problems of determining the best methods for building the optical feedback based light source have been solved through procurement of the optimal components and development of adequate design techniques. The detectors that have been selected exhibit good thermal stability at 660nm wavelength. The light emitting diodes (LED's) are elliptical devices with peak output of 660nm and a half power bandwidth of 25nm. These are the same detectors and basically the same light source as presently used in the Sea Tech transmissometers except in chip form. GRA

N87-25841# Optical Society of America, Washington, D. C.
TOPICAL MEETING ON OPTICAL BISTABILITY (OB3) HELD IN TUCSON, ARIZONA ON DEC. 2-4, 1985
A. W. Lohmann, Demetri Psaltis, S. D. Smith, J. G. Mathew, and M. R. Taghizadeh 31 Dec. 1986 212 p Meeting held in Tucson, Ariz., 2-4 Dec. 1985
(Grant DAAL03-86-G-0009)
(AD-A179982; ARO-23468.2-PH-CF) Avail: NTIS HC A10/MF A01 CSCL 09E

The topical meeting on Optical Bistability provided an international interdisciplinary forum for the exchange of knowledge on the progress of various aspects of optical bistability and optical nonlinearities. The three day program addressed six key areas: (1) Optical bistability in various materials; physics and applications; optical logic gates; etalon and waveguide devices; (2) New schemes and models for optical bistability, including increasing absorption, polarization, crosstrapping bistability, and bistability with surface plasmons; (3) Transverse and longitudinal effects including diffusion, conduction, diffraction, and absorption; (4) Instabilities, noise, fluctuations, and optical chaos; (5) Optical nonlinearities and optical materials including organic, liquid crystal, and semiconductor and photorefractive materials; and (6) Optical computing including architecture, cascading problems, parallel operations, and associate memory phenomena. A total of 97 papers were presented during the three day meeting. GRA

N87-25842# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
PREVENTION OF PRIMARY MIRROR CONTAMINATION BY HELIUM PURGING
Ronald R. Herm, Bernard R. Johnson, and Stephen J. Young 27 Feb. 1987 115 p
(Contract F04701-85-C-0086)
(AD-A180131; TR-0086A(2945-08)-1; SD-TR-87-17) Avail: NTIS HC A06/MF A01 CSCL 17E

Telescopes mounted on space platforms may be subject to performance degradation by the condensation of gaseous species on cryogenically cooled optical surfaces. Attenuations of the flux of impinging contaminants by a purging counterflow of helium (He) gas at the telescope entrance aperture have been calculated by a Monte Carlo procedure that follows individual trajectories selected at random. The calculations involve no significant approximations and should be quite accurate. In particular, multiple-collision trajectories are treated, employing the best available information on the atomic and molecular collision cross sections. Extensive calculations on protection of the Shuttle-mounted CIRRIS I and CIRRIS IA telescopes are presented which illustrate the extent of protection afforded. GRA

N87-25843* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SELF-CLAMPING ARC LIGHT REFLECTOR FOR WELDING TORCH Patent

Stephen S. Gordon, inventor (to NASA) (Rockwell International Corp., Canoga Park, Calif.) 21 Jul. 1987 6 p Filed 30 Sep. 1986 SupersedesN87-15786 (25 - 7, p 961) Continuation-in-part of US-Patent-Appl-SN-783890, US-Patent-4,633,060, dated 3 Oct. 1985
(NASA-Case-MFS-29207-1; US-Patent-4,682,006; US-Patent-Appl-SN-713449; US-Patent-Class-219-124.34; US-Patent-Class-219-74; US-Patent-Class-219-130.01; US-Patent-4,633,060; US-Patent-Appl-SN-783890) Avail: US Patent and Trademark Office CSCL 20F

This invention is directed to a coaxial extending metal mirror reflector attached to the electrode housing or gas cup on a welding torch. An electric welding torch with an internal viewing system for robotic welding is provded with an annular arc light reflector to reflect light from the arc back onto the workpiece. The reflector has a vertical split or gap in its surrounding wall to permit the adjacent wall ends forming the split to be sprung open slightly to permit the reflector to be removed or slipped onto the torch housing or gas cup. The upper opening of the reflector is slightly smaller than the torch housing or gas cup and therefore, when placed on the torch housing or gas cup has that springiness to cause it to clamp tightly on the housing or gas cup. The split or gap also serves to permit the feed of weld wire through to the weld area.
Official Gazette of the U.S. Patent and Trademark Office

N87-25844# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
EXPERIMENTS FOR THE DETERMINATION OF KINEMATIC PARAMETERS FROM OPTICAL FLOW, BASED ON A ROBUST DISPLACEMENT ESTIMATED METHOD [EXPERIMENTE ZUR BESTIMMUNG KINEMATISCHER PARAMETER AUS DEM OPTISCHEN FLUSS BASIEREND AUF EINEM ROBUSTEN VERSCHIEBUNGSSCHAETZVERFAHREN]
R. Kories, G. Zimmermann (Fraunhofer-Inst. fuer Informations- und Datenverarbeitung, Karlsruhe, West Germany), and H. Zinner 1986 7 p In GERMAN Presented at the 8th DAGM, Paderborn, West Germany, 30 Sep.-2 Oct. 1986
(MBB-UA-992/86; ETN-87-99922) Avail: Issuing Activity

A method for the determination of the optical flow from a series of single pictures, which is especially valuable for the evaluation of natural scenes, is presented. The relation between the kinematic parameters of the camera motion and the resulting optical flow was established. The inversion of these equations allows the determination of the motion parameters. A calibrated series of pictures, for which the motion of the camera was a priori known, was evaluated. The experiment shows that the motion can be determined to a good approximation. Television pictures of a three-dimensional, strongly structured scene were evaluated. For comparison, the optical flow vectors were also determined with a correlation method. The deduced kinematic parameters for both methods agree well. ESA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N87-25845# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Mathematics.
STATISTICAL MECHANICS OF COLLECTIVE PHENOMENA IN PLASMAS Final Report, 1 Nov. 1983 - 31 Oct. 1986
Joel L. Lebowitz 31 Oct. 1986 15 p
(Grant AF-AFOSR-0016-82)
(AD-A179868; AFOSR-87-0513TR) Avail: NTIS HC A02/MF A01 CSCL 20I

Progress was made on the statistical mechanics of the Zakharov model which describes the interaction of an electromagnetic wave with a plasma. The model leads to a nonlinear set of partial differential equations which resemble in some ways equations arising in nonlinear field theories which have been studied by statistical mechanical methods. Some very exact results for this model have been obtained in one dimensional and computer simulations are being carried out on it. A new program has been launched involving both theoretical analysis and computer simulations on interacting quantum systems. GRA

N87-25846# Stuttgart Univ. (West Germany). Instr. fuer Raumfahrtsysteme.
BASIC PROCESSES OF PLASMA PROPULSION Final Scientific Report, 1 Aug. 1982 - 31 Jul. 1986
Herbert O. Schrade, Monika Auweter-Kurtz, and Helmut L. Kurtz 30 Jan. 1987 112 p
(Grant AF-AFOSR-0298-82)
(AD-A179884; AFOSR-87-0557TR) Avail: NTIS HC A06/MF A01 CSCL 21C

The current density distribution, flow, pressure, and density fields are calculated for a (quasi-) steady nozzle-type magnetoplasmadynamic (MPD) thruster, based on a partially two dimensional approach, assuming a fully singly ionized plasma with an iso-thermal electron and an adiabatic ion behavior. In addition, for a given current rise, the current contour lines and the flow, pressure, and density fields within the cylindrical flow discharge region are calculated as a function of time. II. In order to investigate the arc stability, a unique theoretical approach is presented which allows determination of the stability behavior of an arbitrarily shaped current-carrying plasma channel under various conditions. Based on this novel theory, the onset phenomenon observed in any nozzle-type MPD arc jets can be predicted; calculated and measured results agree favorably. The cathode attachment of electric arcs are theoretically and experimentally investigated. The erosion effects and the surface damage due to spots are discussed; they stem from evaporation, droplet ejection, and/or splashing. The most severe damage to the cathode surface occurs when many small spots cluster together and build one or even several larger spots which now cause melting and splashing. GRA

N87-25847# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
A SEARCH FOR THE PLASMA PROCESSES ASSOCIATED WITH PERPENDICULAR ION HEATING Final Technical Report
Paul M. Kintner and David J. Gorney 17 Feb. 1987 31 p Prepared in cooperation with Cornell Univ., Ithaca, N.Y.
(Contract F04701-85-C-0086)
(AD-A179972; TR-0086(6940-06)-9; SD-TR-87-15) Avail: NTIS HC A03/MF A01 CSCL 04A

The satellite S3-3 data set has been examined for examples of perpendicular ion acceleration with simultaneous broadband plasma wave data. One event was found. Plasma waves in the frequency range for lower hybrid resonance (LHR) waves and in the frequency range for Doppler shifted O(+) ion cyclotron waves modestly correlated with the perpendicular ion acceleration, although their electric field amplitudes were less than that assumed in present theories of ion acceleration: about 0.2 to 6.0 mV/m (rms) for the LHR waves and 4 to 9 mV/m (rms) for the possible Doppler shifted O(+) cyclotron waves. Plasma waves propagating above the LHR frequency briefly reached a value of 10 mV/m (rms). No evidence was found for the existence of H(+) cyclotron waves during the period of perpendicular ion acceleration. The thermal or superthermal electron field-aligned current density (Ee less than 170 eV), estimated by subtracting the current density measured by the electron spectrometer from that measured by the magnetometer, correlated very well with the period of perpendicular ion acceleration. GRA

N87-25848# Sachs/Freeman Associates, Inc., Landover, Md.
INTERPRETATION OF X-RAY SPECTRA FROM NEON PLASMAS PRODUCED BY GAS IMPLOSIONS
G. Mehlman, P. G. Burkhalter, and D. A. Newman 23 Mar. 1987 34 p
(DNA Proj. T99-QMXLA)
(AD-A180159; NRL-MR-5956) Avail: NTIS HC A03/MF A01 CSCL 20I

Spectroscopic measurements of imploded neon plasmas in the energy range 900 to 1600 eV provide estimates of the plasma

thermodynamic properties. Plasma temperatures are found to be in the range 100 to 140eV. There is experimental evidence for electron densities of several times 10 to the 21st power/cc. Temperature and density gradients are discussed especially for the case of plasmas generated without a fast risetime current driving the implosion. Plasma dynamic properties such as dimensions of the emitting volume for the observed ion radiation and ionic velocities are discussed, based on the spectral line widths. GRA

N87-25894*# Houston Univ., Tex. Dept. of Electronics.
TRANSVERSE DIFFUSION OF ELECTRONS IN A MAGNETOPLASMA
Bernard McIntyre *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, volume 2 Jun. 1987 11 p (For primary document see Summer Faculty Fellowship Program, 1986, volume 2 11 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 20I

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N87-25849*# Claremont Graduate School, Calif.
MODELLING SHORT CHANNEL MOSFETS FOR USE IN VLSI Final Report
Alex Klafter, Stuart Pilorz, Rosa Loguercio Polosa, Guy Ruddock, and Andrew Smith May 1986 79 p Prepared in cooperation with Claremont Mens Coll.,Calif. and Harvey Mudd Coll., Claremont, Calif., Pitzer Coll., Claremont, Calif., Pomona Coll., Claremont, Calif., and Scripps Coll., Claremont, Calif.
(Contract JPL-957377)
(NASA-CR-181087; NAS 1.26:181087) Avail: NTIS HC A05/MF A01 CSCL 20L

In an investigation of metal oxide semiconductor field effect transistor (MOFSET) devices, a one-dimensional mathematical model of device dynamics was prepared, from which an accurate and computationally efficient drain current expression could be derived for subsequent parameter extraction. While a critical review revealed weaknesses in existing 1-D models (Pao-Sah, Pierret-Shields, Brews, and Van de Wiele), this new model in contrast was found to allow all the charge distributions to be continuous, to retain the inversion layer structure, and to include the contribution of current from the pinched-off part of the device. The model allows the source and drain to operate in different regimes. Numerical algorithms used for the evaluation of surface potentials in the various models are presented. J.P.B.

N87-25850# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Nukleare Festkoerperphysik.
THE MAGNETIC BEHAVIOR IN THE MIXED CRYSTAL SYSTEM Rb2CrXMn(1-X)-Cl4 ON THE ANTIFERROMAGNETIC SIDE (x LESS THAN 0.5) Thesis - Marburg Univ., West Germany
E. Naumann Dec. 1986 100 p In GERMAN; ENGLISH summary
(KfK-4175; ISSN-0303-4003; ETN-87-99655) Copyright Avail: NTIS HC A05/MF A01

The competing magnetic interactions and competing anisotropies of the system Rb2CrxMn(1-x) Cl4 in the range of smaller Cr-doping (Mn-rich side) were investigated. The magnetic moments in the x-range between 0 and 0.05 are oriented parallel to the the crystallographic c-axis (easy-axis antiferromagnet). At nearly 5% Cr doped in Rb2MnCl4 the moments lie in the a-b plane perpendicular to the c-direction (forced easy-plane antiferromagnet). This transition does not occur abruptly, but develops continuously in the concentration range between 0.053 and 0.055. At higher Cr-concentrations the planar antiferromagnetism is overlapped by ferromagnetic contributions, and the antiferromagnetic structure is destabilized more and more. The critical magnetic behavior for a sample with x=0.237 is characterized by dominant two-dimensional magnetic interactions in the (001)-plane. A sample with x=0.41 shows a typical glass behavior with strongly marked two-dimensional character. ESA

N87-25851# Maryland Univ., College Park. Dept. of Chemical and Nuclear Engineering.
FUNDAMENTAL STUDIES ON HIGH TEMPERATURE DEFORMATION, RECRYSTALLIZATION, AND GRAIN GROWTH OF TWO-PHASE MATERIALS Interim Technical Report, 1 Sep. 1985 - 30 Nov. 1986
S. Ankem, G. Grewal, and J. G. Shyue 18 Feb. 1987 96 p
(Grant AF-AFOSR-0367-85)
(AD-A179727; AFOSR-87-0458TR) Avail: NTIS HC A05/MF A01 CSCL 11F

The basic factors which control the high temperature deformation, recrystallization, and grain growth of two phase Ti alloys are studied. It is found that the particle growth kinetics of the alpha and beta phases, in titanium alloys, could be represented by simple algebraic equations in terms of time and volume percents of the phases. The observation of the various growth constants in these equations indicated that under identical conditions, the growth of alpha particles in a beta matrix was faster than the growth of beta in an alpha matrix. This was attributed to the higher diffusivities in the beta phase. Furthermore the results of the investigation strongly suggest that one must consider the self diffusivity of the matrix in predicting the growth kinetics, if the self diffusivity is lower than that of the solute. This is in contrast to the present particle coarsening theories which only consider the diffusivity of the solute. It was also found that for identical conditions (volume fraction temperature) particle sizes of the Titanium Vanadium systems were slightly smaller than the Titanium Manganese system. The high temperature deformation studies show that strain softening which occurs in Beta titanium alloys, can also occur in alpha-beta Ti alloys. GRA

N87-25852# City Coll. of the City Univ. of New York. Inst. for Ultrafast Spectroscopy and Lasers.
ULTRAFAST PHYSICS IN MICROSTRUCTURE AND ALLOY SYSTEMS Scientific Report, 1 Dec. 1985 - 30 Nov. 1986
Robert Alfano 15 Feb. 1987 11 p
(Grant AF-AFOSR-0031-86)
(AD-A179728; RF-447230; AFOSR-87-0430TR) Avail: NTIS HC A02/MF A01 CSCL 09A

During year one of AFOSR 860031, significant progress has been achieved in: (1) the main thrust area of ultrafast physics in microstructures and alloys semiconductors - regarding carrier dynamics using picosecond photoluminescence kinetics of 2D Gallium Arsenide/Gallium Aluminum Arsenide (QW) on 2 to 50 pico second time scale; dependence of electron temperature on well width in single Aluminum Indium Galide/Galium Indium Arsenide QW; determination of valence band discontinuity via optical transitions in ultrathin QW; high density electron-hole plasma energy relaxation and rapid expansion; ultrafast carrier recombination relaxation in magnetic semiconductor; and emission and relaxation dynamics in optical deformation semiconductor Cadmium Sulfur Selenide alloy glasses; and in (2) ultrafast pulse propagation in dielectrics and semiconductors - regarding the observation of induced spectral broadening in Zinc Selenide and BK-7 glass. GRA

N87-25853# Energy Innovations, Inc., Houston, Tex.
THIN FILM SOLID STATE CELLS WITH THREE INORGANIC COMPONENTS Final Report, 30 Sep. 1986 - 31 Mar. 1987
Meredith C. Gourdine 30 Apr. 1987 65 p
(Contracts DAAH01-85-C-0975; ARPA Order 5916)
(AD-A179820) Avail: NTIS HC A04/MF A01 CSCL 10C

Thin film solid-state electrochemical cells with inorganic components were investigated. Various combinations of materials and fabrication techniques were studied and classified to determine which had the better chance for commercialization. Theoretical predictions were verified by experiments, providing a sound basis

for predicting promising combinations. These thermovoltaic cells are divided into 2 main categories; Large cells that are maintained at a high operating temperature by joule heat; and small or medium size cells that operate close to room temperature, in a humid environment. Within these categories, there are primary and secondary type cells that offer distinct advantages over commercially available cells in both performance and price. High specific power (100 watt/lb.) and specific energy (1000 watt-hr/lb) are achieved by eliminating weight of chemical oxidizers, massive electrodes and enclosures used in conventional batteries. GRA

N87-25854# Harry Diamond Labs., Adelphi, Md.
THEORY OF BELOW-BAND-GAP PHOTOLUMINESCENCE IN A GALLIUM ARSENIDE DOPING SUPERLATTICE Progress Report, May - Oct. 1986
John D. Bruno Dec. 1986 39 p
(AD-A179941; HDL-TR-2100) Avail: NTIS HC A03/MF A01 CSCL 20L

This report presents a simplified calculation of the photoluminescence spectrum of a gallium arsenide doping superlattice. The electronic states in the conduction band of the superlattice are taken to be harmonic oscillator-like in the doping direction and free particle-like in the transverse directions. Localized acceptor states above the valence band are represented by spherically symmetric hydrogenic functions. Analytic expressions for the electric dipole matrix element between these states are obtained and are employed in the numerical evaluation of the spectrum for different electronhole distribution functions. GRA

N87-25855# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
EPITAXIAL HEXAGONAL FERRITES FOR MILLIMETER WAVE DEVICES Final Technical Report, 1 Oct. 1983 - 31 Dec. 1986
H. L. Glass Feb. 1987 25 p
(Contract DAAG29-83-C-0032; DA Proj. 1L1-61102-BH-57)
(AD-A179977; SC5387.FR; ARO-20105.1-EL) Avail: NTIS HC A02/MF A01 CSCL 20B

The objective of this research was to develop single crystal hexagonal ferrite films of superior quality. These films would be useful in millimeter wave devices such as tunable filters. They also would be useful in studying basic magnetic phenomena in these materials; for example, their high magnetocrystalline anisotropy. A novel two-step liquid phase epitaxy (LPE) process was developed which resulted in improved quality of barium hexaferrite films deposited on gallate spinel substrates (indium substituted magnesium gallium oxide spinel). The two-step process entailed the growth of a thin epitaxial film of a spinel ferrite prior to deposition of the desired hexagonal ferrite. The hexagonal ferrite films obtained by this method were more uniform and more strongly bonded to the substrate than films grown without the intermediary spinel ferrite layer. The hexagonal ferrite films exhibited large, rounded hillocks that appeared to be associated with defects in the substrate crystals. Ferromagnetic resonance measurements were made at 60 GHz. External dc magnetic bias fields of about 9 KOe were required for resonance, as expected for barium hexaferrite. Resonance linewidths were about 50 to 60 oersted. Substantial reductions in linewidth should be achievable with further improvements in crystal quality. Author (GRA)

N87-25856# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SATURATION OF RESPONSE OF PbS INFRARED DETECTORS UNDER HIGH FLUX
Alfred A. Fote 10 Apr. 1987 18 p
(Contract F04701-85-C-0086)
(AD-A179983; TR-0084A(5409-11)-1; SD-TR-87-16) Avail: NTIS HC A02/MF A01 CSCL 17E

Laboratory and mathematical results are provided to show that chopped radiation is approximately twice as effective as steady background radiation in causing saturation of PbS infrared detector performance at high flux levels. GRA

N87-25857# Motorola, Inc., Scottsdale, Ariz. Government Electronics Group.
SOLID-STATE THRESHOLD ACCELEROMETER CHIP Final Report, Sep. 1985 - Mar. 1987
Lou Faraco and Al Meyer 28 Mar. 1987 100 p
(Contract DAALO2-85-C-0146; DA Proj. 1L1-61101-A-91-A)
(AD-A180112; HDL-CR-86-146-1) Avail: NTIS HC A05/MF A01 CSCL 19A

Micromechanical cantilever beam structures having a maximum length of 0.16 in. were designed, fabricated, and tested in six configurations for use as threshold acceleration sensors for projectile fuzes. Their small size and ability to be produced using monolithic fabrication techniques commonly used to make integrated circuits provides the possibility of incorporating multiswitch arrays into a single die surface area one hundredth of a square inch. Design, fabrication, and test details are provided for two triple-beam arrays of cantilever structures made from 3-micrometer-thick silicon dioxide. Author (GRA)

N87-25858# GTE Systems Group, Phoenix, Ariz.
ELECTRICAL CHARACTERIZATION OF VLSI RAMS AND PROMS Final Report, Mar. 1984 - Jun. 1986
M. Formoso, D. Giammarrusco, G. Hornbuckle, R. Henrikson, and E. Rolley Oct. 1986 397 p
(Contract F30602-84-C-0078)
(AD-A180114; RADC-TR-86-180) Avail: NTIS HC A17/MF A01 CSCL 20L

Extensive electrical characterizations were performed on 256K bit and 512K bit ultra violet erasable PROMs (UVEPROMs), 64K bit electrically erasable PROMs (EEPROMs), 64K static RAMs (organized as 8Kx8 bits), 256K dynamic RAMs (CMOS) and 32R16 PAL devices available from the merchant semiconductor industry. Based on the data obtained from the devices, parameter limits were established and proposed for the draft MIL-M-38510/XXX specifications. The data, proposed limits and test methodologies and the related discussions are presented. GRA

N87-25859# Florida Univ., Gainesville. Dept. of Chemical Engineering.
THE COUPLING OF THERMOCHEMISTRY AND PHASE DIAGRAMS FOR GROUP III-V SEMICONDUCTOR SYSTEMS Progress Report, 1 Sep. 1986 - 31 Aug. 1987
T. J. Anderson May 1987 10 p
(Contract DE-FG05-86ER-45276)
(DE87-006621; DOE/ER-45276/1) Avail: NTIS HC A02/MF A01

Assessment studies revealed inconsistencies in reported TI activities. Ga and In activities were measured as a function of temperature and composition in liquid Ga-TI and In-TI alloys. Large positive deviations from ideal solution behavior were found in Ga-TI while the In-TI system showed nearly ideal behavior. The extent of solid solution in the compound AlSb was determined by electrochemical titration with a measured range 8 x 10 to the -4 to 2 x 10 to the -3 mole fraction at 846 C. The enthalpy of mixing GaP and InP to form the pseudobinary solid solution Ga(sub x)In(sub 1-x)P was determined by solution calorimetry. A positive enthalpy of mixing was reported. Knudsen effusion studies were performed on Ga(sub x)In(sub 1-x)P alloys. Results indicate the existence of a solid miscibility gap in this system. CALPHAD procedures were applied to the Al-Ga-In-Sb pseudoternary and Ga-In-Sn ternary systems. DOE

N87-25860# Sandia National Labs., Albuquerque, N. Mex.
CRYSTAL STRUCTURE REFINEMENTS OF RHOMBOHEDRAL SYMMETRY MATERIALS CONTAINING BORON-RICH ICOSAHEDRA
B. Morosin, T. L. Aselage, and R. S. Feigelson 1987 7 p
Presented at the Spring Meeting of the Materials Research Society, Anaheim, Calif., 21 Apr. 1987 Prepared in cooperation with Stanford Univ., Calif.
(Contract DE-AC04-76DP-00789)
(DE87-009050; SAND-87-1070C; CONF-870438-9) Avail: NTIS HC A02/MF A01

The crystal structures of several icosahedral boron-containing compounds have been refined using MoK alpha intensity data. Preparation of crystals differs from previous procedures, with boron carbide grown from molten copper and boron arsenide by arsenic vapor transport. The structures consist of icosahedral units bonded together with direct B-B bonds as well as other linkage units (B-C-B and As-As chains). DOE

N87-25861# California State Coll., Fullerton.
SYNCHROTRON X-RAY TOPOGRAPHY OF DISLOCATION ARRAYS
J. C. Bilello 1986 12 p Presented at the Materials Research Society Fall Meeting, Boston, Mass., 1 Dec. 1986
(Contract DE-FG02-84ER-45098)
(DE87-009338; DOE/ER-45098/21; CONF-861207-100) Avail: NTIS HC A02/MF A01

The application of relatively low resolution x-ray topography methods, typically approx 1 micrometer, is limited in studies which involve large scale dislocation networks. However, the ability to nondestructively image wide areas for thick specimens at high intensity with a tunable x-ray source makes the synchrotron an ideal probe for a range of problems previously inaccessible by other methods. Some examples are discussed such as: (a) crack initiation and propagation in fatigued zinc bicrystals; (b) real-time in situ plastic deformation studies in stain-annealed Mo crystals; and (c) strain distributions in vapor deposited and LPE thin films on Si and GaAs substrates. DOE

N87-25862* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LASER SCHLIEREN CRYSTAL MONITOR Patent
Robert B. Owen, inventor (to NASA) and Mary H. Johnston, inventor (to NASA) 21 Jul. 1987 7 p Filed 28 Feb. 1985 Supersedes N85-30932 (23 - 19, p 3374)
(NASA-Case-MFS-28060-1; US-Patent-4,681,437; US-Patent-Appl-SN-706565; US-Patent-Class-356-129; US-Patent-Class-356-128) Avail: US Patent and Trademark Office CSCL 20B

A system and method for monitoring the state of a crystal which is suspended in a solution is described which includes providing a light source for emitting a beam of light along an optical axis. A collimating lens is arranged along the optical axis for collimating the emitted beam to provide a first collimated light beam consisting of parallel light rays. By passing the first collimated light beam through a transparent container, a number of the parallel light rays are deflected off the surfaces of said crystal being monitored according to the refractive index gradient to provide a deflected beam of deflected light rays. A focusing lens is arranged along optical axis for focusing the deflected rays towards a desired focal point. A knife edge is arranged in a predetermined orientation at the focal point; and a screen is provided. A portion of the deflected beam is blocked with the knife edge to project only a portion of the deflected beam. A band is created at one edge of the image of the crystal which indicates the state of change of the surface of the crystal being monitored.
Official Gazette of the U.S. Patent and Trademark Office

N87-25863# Utah Univ., Salt Lake City. Dept. of Physics.
NOISE IN LEAD BETA ALUMINA Technical Report, 1 Feb. - 1 May 1987
James J. Brophy and J. J. Carroll May 1987 6 p
(Contract N00014-82-K-0603)
(AD-A180222; TR-11) Avail: NTIS HC A02/MF A01 CSCL 20E

Conductivity fluctuations ascribed to diffusion noise of the mobile ions have been observed in single crystal and polycrystalline ceramic Pb Beta alumina. The observed noise levels are much greater and the temperature dependence stronger than predicted by the standard expression for diffusion noise. The calculated effective ion density, ten to the tenth power ions/cm3, is two orders of magnitude larger than that of Na Beta alumina and Ag Beta alumina. This can be attributed to smaller correlation effects between the mobile ions because of the lesser actual mobile ion density in Pb Beta alumina. GRA

N87-25864# Stanford Univ., Calif. Electronics Lab.
STUDY OF INTERFACIAL CHEMISTRY BETWEEN METALS AND THEIR EFFECTS ON ELECTRONIC SYSTEMS Semiannual Technical Report, 1 Apr. - 30 Sep. 1986
W. E. Spicer and I. Lindau 30 Sep. 1986 5 p
(Contract N00014-83-K-0073; ARPA Order 3564)
(AD-A180324) Avail: NTIS HC A02/MF A01 CSCL 09A

We studied the electrical properties of a large number of metal p type diodes which were fabricated by in situ metal deposition on atomically clean InP (110) surfaces in ultra high vacuum. Schottky barrier heights were determined from current-voltage (I-V) and capacitance-voltage (C-V) measurements. We found a small, but significant range in barrier heights (0.76 eV to 0.98 eV). Comparison of these p-type results to our earlier work on n-type surfaces shows that for these interfaces, Fermi level of n-type and p-type samples is pinned at the same energy within the bandgap. These results are similar to those previously reported by us for the GaAs interfaces prepared under the same conditions (only the absolute values of the pinning energies are different). Our results indicate that Schottky barrier models that use metal-independent interface states and potential normalization conditions (i.e., natural band lineups) can predict the general trends in the interface Fermi level pinning behavior. They fail, however, to provide quantitative agreement with experiment. We applied a theoretical method to determine the natural band lineups at the interface (using a scheme due to O.K. Anderson) and found that the use of work functions or electronegativities gives analogous correlations. GRA

N87-25865# Stanford Univ., Calif. Lab of Physics.
RESEARCH ON CRYOGENIC VACUUM TUNNELING Final Report, 1 Aug. 1984 - 31 Jan. 1987
C. F. Quate Apr. 1987 7 p
(Contract N00014-84-K-0549)
(AD-A180341; GL-4194) Avail: NTIS HC A02/MF A01 CSCL 20F

The Scanning Tunneling Microscope (STM) has been designed and constructed to operate at low temperature. In liquid helium at 4 K we have mapped the spatial variation of the superconducting energy gap. It, also, has been used for the first time to record the vibrational spectra of a molecule adsorbed on graphite and to image the molecule itself. The STM has also been used to record the phonon spectra of the graphite substrate. This is a new tool for low temperature studies which enables us to study the spatial variations in structure and spectra. GRA

N87-25866# California Inst. of Tech., Pasadena.
DEVICE PHYSICS OF SUPERLATTICES AND SMALL STRUCTURES Final Report, 1 Aug. 1983 - 30 Nov. 1986
T. C. McGill 10 Apr. 1987 88 p
(Contract DAAG29-83-K-0104)
(AD-A180473; ARO-20643.10-EL) Avail: NTIS HC A05/MF A01 CSCL 07E

Experimental and theoretical studies are presented of HgTe CdTe superlattices. We report the first study of the photoluminescence and photoconductivity spectra of superlattices. Photoluminescence, photoconductivity and infrared absorption all point to the same band gap for the superlattice. Theoretical studies of these superlattices have given the first estimates of the magnitude of the optical absorption, the first study of the role of strain, and the first study of the role of the band offset in determining the properties of superlattices. We have also invented a novel electronic device that negative resistance based on HgCdTe-CdTe-HgCdTe heterostructures. The first theoretical studies of superlattices are carried out that include dilute magnetic semiconductors. Superlattices of CdTe-ZnTe have been studied experimentally and theoretically to give the first investigations of the properties of possible II-IV visible light emitters. GRA

N87-25867# Defense Science Board, Washington, D. C.
REPORT OF DEFENSE SCIENCE BOARD TASK FORCE ON DEFENSE SEMICONDUCTOR DEPENDENCY
Feb. 1987 115 p
(PB87-164562) Avail: NTIS HC A06/MF A01 CSCL 20L

The impact of dependency of the U.S. military on foreign sources for semiconductor devices is addressed. All of the authors advanced military systems to make use of such devices. Their remarkable technology achievements in seimconductor devices account, in large measure, for the superior performance of all their advanced systems. It was concluded that, while the current dependency on foreign sources is modest today, semiconductor manufacturing trends indicate that they will become highly dependent in the future if immediate actions are not taken. The most significant finding of the Task Force is that U.S. technology leadership in this critical area is rapidly eroding and that this has serious implications for the national economy and immediate and predictable consequences for the Defense Department. GRA

N87-25868*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIQUID ENCAPSULATED CRYSTAL GROWTH Patent Application
Andrew D. Morrison, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 20 Feb. 1987 20 p
(Contract NAS7-918)
(NASA-Case-NPO-16808-1-CU; US-Patent-Appl-SN-027981)
Avail: NTIS HC A02/MF A01 CSCL 20L

Low-defect crystals are grown in a closed ampoule under a layer of encapsulant. After crystal growth, the crystal is separated from the melt and moved into the layer of encapsulant and cooled to a first temperature at which crystal growth stops. The crystal is then moved into the inert gas ambient in the ampoule and further cooled. The crystal can be separated from the melt by decanting the melt into and adjacent reservoir or by rotating the ampoule to rotate the crystal into the encapsulant layer. NASA

N87-25869# Technische Univ., Munich (West Germany). Lehrstuhl fuer Technische Elektronik.
AN ELECTRON BEAM MEASURING METHOD FOR THE DETERMINATION OF THE MINORITY CARRIER LIFETIME IN GaAs P:N LUMINESCENCE DIODES Ph.D. Thesis [EIN ELEKTRONENSTRAHLMESSVERFAHREN ZUR BESTIMMUNG DER MINORITAETSTRAEGERLEBENSDAUER IN GaAsP:N-LUMINESZENDIODEN]
Hans Schmuderer 1985 182 p In GERMAN
(ETN-87-99344) Avail: NTIS HC A09

An electron beam method was developed for the space-resolved measurement of the minority carrier lifetime in the upper semiconductor zone (planar techniques) in LED's. The measuring method belongs to the electron-beam-induced-current (EBIC) group. Since the generation distribution is also considered, the method is (besides for silicon), also suited for semiconductor materials with diffusion lengths of the order of the electron beam range. The minority carriers, produced by the intensity-modulated beam, reach the space charge zone of the p-n transition by diffusion and drift, resulting in an ac current signal. The semiconductor parameters were obtained from a comparison between measured and calculated current amplitudes and phases. The data for the investigated GaAsp:N LED's are given. The spatial resolution is 2 to 3 micron. A clear correlation between basic doping and diffusion lengths and lifetimes is found. The advantages of the method with respect to other methods are depicted. ESA

N87-25627# Brown Univ., Providence, R. I.
RAPID LIQUID PHASE EPITAXY OF III-V SEMICONDUCTORS
J. T. Daly, H. J. Gerritsen, E. E. Crisman, and S. K. F. Karlsson *In* Midwest Research Inst., SERI PV AR/D University Participation Program Apr. 1987 p 77-83 (For primary document see N87-25622 19-44)
Avail: NTIS HC A05/MF A01

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N87-25870# Fermi National Accelerator Lab., Batavia, Ill.
COSMOLOGICAL STABILITY OF QUANTUM COMPACTIFICATION
M. Gleiser Feb. 1987 8 p Presented at the Texas Symposium, Chicago, Ill., 14 Dec. 1986
(Contract DE-AC02-76CH-03000)
(DE87-007035; FNAL/C-87/32-A; CONF-861264-5) Avail: NTIS HC A02

We discuss the cosmological stability of higher dimensional models that feature internal manifolds given by the product of two spheres. In particular, we consider the case when the total number of dimensions is even. After we obtain the vacuum energy coming from one-loop fluctuations of scalars and spin-1/2 fermions, we show how a realistic cosmological scenario can arise by balancing the quantum energy with monopole-like contributions. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N87-25871# Office of Management and Budget, Washington, D.C. Subcommittee on Statistical Uses of Microcomputers in Federal Agencies.
WORKSHOP ON STATISTICAL USES OF MICROCOMPUTERS IN FEDERAL AGENCIES
1 Apr. 1987 104 p Proceedings of Workshop held in Washington, D.C., 24 Apr. 1985
(PB87-166393; STATISTICAL-POLICY-WP-14) Avail: NTIS HC A06/MF A01 CSCL 05A

The Subcommittee on Statistical Uses of Microcomputers in Federal Agencies organized a one-day workshop held on April 24, 1985. The working paper is based on the workshop and discusses four topics: planning to buy and use microcomputers for statistical purposes; electronic data dissemination; applications of microcomputers; and expert systems. The report is intended to provide helpful guidance to Federal agencies in purchasing and using microcomputers for statistical purposes. GRA

N87-25872# General Accounting Office, Washington, D. C. General Government Div.
SMALL BUSINESS ACT: NASA'S (NATIONAL AERONAUTICS AND SPACE ADMINISTRATION'S) DISADVANTAGED BUSINESS ADVOCATE NOT REPORTING TO PROPER MANAGEMENT LEVEL
Apr. 1987 9 p
(PB87-176798; GAO/GGD-87-50; B-222903.12) Avail: NTIS HC A02/MF A01 CSCL 05A

The report reviews 13 agencies to determine their compliance with Section 15(k) of the Small Business Act. In subsequent discussions, the Chairman's office defined the primary concern as the agency's compliance with Section 15(k)(3), which described the required reporting level for each agency's director, Office of

Small and Disadvantaged Business Utilization (OSDBU). The National Aeronautics and Space Administration (NASA) was one of the agencies selected. GRA

N87-25873# General Accounting Office, Washington, D. C. Resources Community and Economic Development Div.
AVIATION ACQUISITION: IMPROVED PROCESS NEEDS TO BE FOLLOWED
Mar. 1987 48 p
(PB87-180188; GAO/RCED-87-8; B-225281) Avail: NTIS HC A03/MF A01 CSCL 05A

The report responds to a request for continuing reviews of the Federal Aviation Administration's (FAA) National Airspace System (NAS) plan. It addresses FAA's management of the acquisition process used in implementing its plan. GRA

N87-25898*# Prairie View Agricultural and Mechanical Coll., Tex.
AFFIRMATIVE ACTION AS ORGANIZATION DEVELOPMENT AT THE JOHNSON SPACE CENTER
Mfanya Donald L. Tryman *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 34 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 34 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 05A

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N87-25874*# Pennsylvania State Univ., University Park. Dept. of Geography.
ADVANCED TECHNIQUES FOR THE STORAGE AND USE OF VERY LARGE, HETEROGENEOUS SPATIAL DATABASES Midyear Progress Report, 1 Jul. 1986 - 1 Apr. 1987
Donna J. Peuquet Apr. 1987 31 p
(Grant NAG5-798)
(NASA-CR-181053; NAS 1.181053) Avail: NTIS HC A03/MF A01 CSCL 05B

Progress is reported in the development of a prototype knowledge-based geographic information system. The overall purpose of this project is to investigate and demonstrate the use of advanced methods in order to greatly improve the capabilities of geographic information system technology in the handling of large, multi-source collections of spatial data in an efficient manner, and to make these collections of data more accessible and usable for the Earth scientist. Author

N87-25875 Huebner (Thomas), Ebermannstadt (West Germany).
BIBLIOGRAPHY OF THE INDEPENDENT GERMAN LANGUAGE NONTECHNICAL LITERATURE ON ASTRONAUTICS [BIBLIOGRAPHIE DER SELBSTAENDIGEN DEUTSCHSPACHIGEN NICHTTECHNISCHEN. LITERATUR ZUR RAUMFAHRT. BERICHTSZEIT: JH.-1984]
Thomas Huebner 1985 116 p In GERMAN
(ETN-87-99666) Avail: NTIS Fachinformationszentrum, Karlsruhe, West Germany

The bibliography contains books, journals, yearbooks, and maps from the beginning of astronautics (nineteenth century) through 1984. (About 900 references). ESA

N87-25876# Air Command and Staff Coll., Maxwell AFB, Ala.
SERVICES INFORMATION MANAGEMENT SYSTEM (SIMS) USERS' HANDBOOK
Donna G. Barnett and David B. White Apr. 1987 66 p
(AD-A179874; ACSC-87-0155) Avail: NTIS HC A04/MF A01 CSCL 05B

The Services Information Management System (SIMS) Users' Handbook was prepared to assist the Air Force Engineering and Services Center (AFESC) to successfully implement and effectively operate SIMS throughout the Air Force. The handbook is primarily intended for use by base-level Services managers, supervisors, and key SIMS administrative personnel, but is also recommended for all base-level Services personnel. The handbook provides a broad overview of SIMS philosophy and operational concepts to ease the transition to automated information management in the Services business. The areas addressed in the handbook include SIMS management concepts, Services' customer commitment philosophy, SIMS hardware and software, operational concepts, SIMS evolution and growth, and potential pitfalls. The handbook is not intended to supersede existing AFESC or MAJCOM guidance, or technical references already available. GRA

N87-25877# Army Armament Research and Development Command, Dover, N. J. Information Management Directorate.
PROCEEDINGS OF THE INTERNATIONAL DEFENSE INFORMATION CONFERENCE (IDIC) (1ST) HELD IN BOSTON, MASSACHUSETTS ON 9-10 JUNE 1986
Normand L. Varieur Apr. 1987 147 p Conference held in Boston, Mass., 9-10 Jun. 1986
(AD-A180372; ARIMD-SP-87001) Avail: NTIS HC A07/MF A01 CSCL 05B

This conference brought together, in an international forum, military librarians, defense publishers, and heads of military information services. The participants reviewed what was being done in the way of new services both by the defense departments of various countries and by the publishers of major defense journals

N87-25878# Office of Management and Budget, Washington, D.C.
MANAGING FEDERAL INFORMATION RESOURCES: REPORT UNDER THE PAPERWORK REDUCTION ACT OF 1980 Annual Report No. 5
Apr. 1987 62 p
(PB87-114138) Avail: NTIS HC A04/MF A01 CSCL 05B

The report describes the Office of Management and Budget's progress in managing and overseeing information gathering, processing, and dissemination functions of the Federal government. It includes progress and continuing efforts in strengthening information management within the Federal government, improving Federal statistical programs and reducing information collection burdens imposed upon the public as well as State and local governments. GRA

N87-25879# Lister Hill National Center for Biomedical Communications, Bethesda, Md.
RESEARCH LIBRARY TRENDS, 1951-1980 AND BEYOND: AN UPDATE OF PURDUE'S PAST AND LIKELY FUTURE OF 58 RESEARCH LIBRARIES Final Technical Report
Warren F. Seibert, Marjorie A. Kuenz, Paul A. Games (Pennsylvania State Univ., University Park.), and Richard W. Gregg Mar. 1987 196 p
(PB87-174280; LHNCBC-87-2) Avail: NTIS HC A09/MF A01 CSCL 05B

The research extends the Purdue studies of research library growth, presenting results that include library statistical trends during a 35 year period, 1951 to 1985. This study serves to update Purdue's nine-report series (1965 through 1973) and is a validation study of Purdue's growth forecasts, 28 of which were published in 1965, then revised in 1971. The research libraries considered here represent 58 first tier American reseach universities that were members of the Association of Reseach Libraries (ARL) in 1964, when the Purdue studies began; all are still members. The results describe 35 years of growth and change in library holdings, volumes added, professional and nonprofessional staff size, and in three

expenditure categories (salaries, materials and binding, and total), and total, plus university/main campus total and graduate enrollments, and Ph.D. degrees awarded. Growth trends are reported for eight composite libraries that differ in size, i.e., the average or mean; the median, first quartile and third quartile; and four collection (or holdings) subgroups: the large, medium-large, medium-small, and small. Correlation findings also show the strength of relationship, year-by-year, among the study variables. Some estimates of future growth through 1990 are presented together with suggestions for further research. GRA

N87-25273*# FWG Associates, Inc., Tullahoma, Tenn.
MODELING AND IMPLEMENTATION OF WIND SHEAR DATA
Walter Frost *In* NASA. Langley Research Center Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Jul. 1987 p 49-66 (For primary document see N87-25267 19-01)
Avail: NTIS HC A12/MF A01 CSCL 05B

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

N87-25880# General Accounting Office, Washington, D. C. National Security and International Affairs Div.
SPACE FUNDING: NASA'S APPROPRIATIONS AND DOD'S FUNDING ESTIMATES FOR SPACE PROGRAMS
Feb. 1987 30 p
(PB87-167888; GAO/NSIAD-87-81-FS; B-226100) Avail: NTIS HC A03/MF A01 CSCL 05A

The report covers the following topics: NASA's space funding; DOD's space funding estimates; Comparison of NASA's appropriations and DOD's space funding estimates; Tables; Figures; and Abbreviations. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N87-25881# Air Command and Staff Coll., Maxwell AFB, Ala.
TECHNOLOGY TRANSFER: ITS IMPLICATIONS FOR THE DEPARTMENT OF DEFENSE (DOD)
Teddy N. Wang Apr. 1987 46 p
(AD-A179842; ACSC-87-2645) Avail: NTIS HC A03/MF A01 CSCL 05B

This paper addresses the transfer of Western technology to the Soviet Union. By understanding the Soviets' efforts, organization, and methods to acquire Western technology, the reader can appreciate the significance of the technology transfer problem--especially to the military. The paper will also address current US controls to counter the exit of technology and concludes with recommendations that could further stem the flow of Western technology to the Soviet Union. GRA

N87-25882# SES Development Corp., Arlington, Va.
GLOBAL COMPETITION AND TECHNOLOGY TRANSFER BY THE FEDERAL LABORATORIES: AN ASSESSMENT OF TECHNOLOGY TRANSFER MECHANISMS OF SELECTED NATIONAL LABORATORIES WITH A SPECIAL FOCUS ON SOLAR/RENEWABLE ENERGY TECHNOLOGIES, EXECUTIVE SUMMARY
R. E. Engler, Jr. and P. G. Vargas 20 Feb. 1987 131 p
(Contract DE-AC01-85CE-30848)
(DE87-008906; DOE/CE-30848/T1) Avail: NTIS HC A07/MF A01

The report is presented in five chapters. It begins with an overview of the general problem and an introduction to the special case of renewable energy. Then, in Chapter Two, a broad canvas is presented for considering technology transfer as technology development to solve priority social-technical problems faced by our society; and important historical features in America's past are presented along with speculation about their relevance to the present and future. Chapter Three describes the four selected national laboratories and their current efforts at enhancing technology transfer. Chapter Four pulls together key findings from the lab descriptions and other sources and presents them as continuing issues and guiding principles. Finally, in Chapter Five, recommendations are made to SERI, the Solar Energy Research Institute, for both the short range and long range. Long-range recommendations foresee a changed, more supportive climate and budget for solar/renewable energy and speculate about a far-reaching role for those technologies in a national effort at societal revitalization, redevelopment and renewal. DOE

N87-25883# Office of Technology Assessment, Washington, D.C.
REPORT TO THE CONGRESS, FISCAL YEAR 1985 (OFFICE OF TECHNOLOGY ASSESSMENT) Annual Report
Mar. 1986 122 p
(PB87-177804; OTA-A-289) Avail: NTIS HC A06/MF A01 CSCL 05A

The report summarizes the activities of the Office of Technology Assessment for the calendar year 1985. Included are discussions of its organization and operation; summaries of assessments completed during 1985; descriptors of work in progress; a list of staff members, advisers and panel members. A copy of the Technology Assessment Act of 1972 is also included. GRA

N87-25884*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)/AMERICAN SOCIETY FOR ENGINEERING EDUCATION (ASEE) SUMMER FACULTY FELLOWSHIP PROGRAM, 1986, VOLUME 2
Bayliss McInnis, ed. (Houston Univ., Tex.) and Stanley Goldstein, ed. Jun. 1987 286 p
(Grant NGT-44-005-803)
(NASA-CR-171984-Vol-2; NAS1.26:171984-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 05A

The Johnson Space Center (JSC) NASA/ASEE Summer Faculty Fellowship Program was conducted by the University of Houston and JSC. The ten week program was operated under the auspices of the American Society for Engineering Education (ASEE). The basic objectives of the program are (1) to further the professional knowledge of qualified engineering and science faculty members; (2) to stimulate an exchange of ideas between participants and NASA; (3) to enrich and refresh the research and teaching activities of participants' institutions; and (4) to contribute to the research objectives of the NASA Centers. Each faculty fellow spent ten weeks at JSC engaged in a research project commensurate with his interests and background and worked in collaboration with a NASA/JSC colleague. The final reports on the research projects are presented. This volume, 2, contains sections 15 through 30. For individual titles, see N87-25885 through N87-25900.

N87-25885*# Houston Univ., Tex. Dept. of Mathematics.
SOLAR PREDICTION AND INTELLIGENT MACHINES c92
Gordon G. Johnson *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 6 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 6 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 03B

The solar prediction program is aimed at reducing or eliminating the need to throughly understand the process previously developed and to still be able to produce a prediction. Substantial progress was made in identifying the procedures to be coded as well as testing some of the presently coded work. Another project involves work on developing ideas and software that should result in a machine capable of learning as well as carrying on an intelligent conversation over a wide range of topics. The underlying idea is to use primitive ideas and construct higher order ideas from these, which can then be easily related one to another. Author

N87-25886*# LeTourneau Coll., Longview, Tex. Dept. of Chemistry.
NON-EQUILIBRIUM EFFECTS IN HIGH TEMPERATURE CHEMICAL REACTIONS c25
Richard E. Johnson *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer FAculty Fellowship Program, 1986, Volume 2 Jun. 1987 18 p (For primary document see Summer FAculty Fellowship Program, 1986, Volume 2 18 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 07D

Reaction rate data were collected for chemical reactions occurring at high temperatures during reentry of space vehicles. The principle of detailed balancing is used in modeling kinetics of chemical reactions at high temperatures. Although this principle does not hold for certain transient or incubation times in the initial phase of the reaction, it does seem to be valid for the rates of internal energy transitions that occur within molecules and atoms. That is, for every rate of transition within the internal energy states of atoms or molecules, there is an inverse rate that is related through an equilibrium expression involving the energy difference of the transition. Author

N87-25887*# Lamar Univ., Beaumont, Tex. Dept. of Geology.
RARE GAS ANALYSIS OF SIZE FRACTIONS FROM THE FAYETTEVILLE METEORITE c90
Jim L. Jordan *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 13 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 13 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 03B

Eight size separates of grains from the Fayetteville meteorite ranging from less than 20 microns to greater than 1 millimeter are being analyzed for their rare gas elemental and isotopic composition. Measurements on five samples were performed. All five reveal a mixture of solar, planetary, cosmic ray produced and radiogenic gases. The solar component is of particular interest since it suggest that the meteorite may represent a fragment of an ancient protoplanetary regolith which was exposed to the solar wind. Solar wind elements are implanted in the outer few hundred Angstroms of exposed grains and are therefore expected to be surface correlated. At present the data do not suggest that such a correlation exists, but the final conclusion must await further analyses and data reduction. Author

N87-25888*# New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.
AN ANALYSIS OF BIPROPELLANT NEUTRALIZATION FOR SPACECRAFT REFUELING OPERATIONS c28
David Kauffman *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 14 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 14 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 21H

Refueling of satellites on orbit with storable propellants will involve venting part or all of the pressurant gas from the propellant tanks. This gas will be saturated with propellant vapor, and it may also have significant amounts of entrained fine droplets of propellant. The two most commonly used bipropellants, monomethyl hydrazine (MMH) and nitrogen tetroxide (N_2O_4), are highly reactive and toxic. Various possible ways of neutralizing the vented propellants are examined. The amount of propellant vented in a typical refueling operation is shown to be in the range of 0.2 to 5% of the tank capacity. Four potential neutralization schemes are examined: chemical decomposition, chemical reaction, condensation and adsorption. Chemical decomposition to essentially inert materials is thermodynamically feasible for both MMH and N_2O_4. It would be the simplest and easiest neutralization method to implement. Chemical decomposition would require more complex control. Condensation would require a refrigeration system and a very efficent phase separator. Adsorption is likely to be much heavier. A preliminary assessment of the four neutralization shemes is presented, along with suggested research and development plans. Author

N87-25889*# South Carolina State Coll., Orangeburg. Dept. of Mathematics and Computer Science.
GEOMETRIC DESCRIPTION AND GRID GENERATION FOR SPACE VEHICLES c34
Madakasira G. Krishna *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 16 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 16 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 20D

The understanding and analysis of three dimensional fluid behavior around reentry vehicles, like the Space Shuttle Orbiter, is of considerable importance for flight applications. Vehicle designers need pressure, heat transfer, and shear distributions to support design activities. Traditionally these have been obtained by experimental data. Significant reduction in design costs can be obtained if the calculated results based on finite difference procedures are used to verify and supplement experimental results. Computing the flow field over Space Shuttle Orbiter, which has complex cross sectional geometries is a major problem. A first step in this direction is development of body definition and grid generation procedure. In this project a digitized body definition and grid generation procedure, developed earlier at JSC, is modified and applied to the Shuttle Orbiter X24C-10D. Two dimensional grid and body definition for various sections of the space vehicle is obtained using the differential equation method. This study demonstrates that this geometry and grid generation procedure can be applied to other aerospace vehicles such as aerospaceplanes. Author

N87-25890*# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Electrical Engineering and Computer Science.
INTEGRATION OF COMMUNICATIONS AND TRACKING DATA PROCESSING SIMULATION FOR SPACE STATION c32
Robert C. Lacovara *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 11 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 11 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 17B

A simplified model of the communications network for the Communications and Tracking Data Processing System (CTDP) was developed. It was simulated by use of programs running on several on-site computers. These programs communicate with one

another by means of both local area networks and direct serial connections. The domain of the model and its simulation is from Orbital Replaceable Unit (ORU) interface to Data Management Systems (DMS). The simulation was designed to allow status queries from remote entities across the DMS networks to be propagated through the model to several simulated ORU's. The ORU response is then propagated back to the remote entity which originated the request. Response times at the various levels were investigated in a multi-tasking, multi-user operating system environment. Results indicate that the effective bandwidth of the system may be too low to support expected data volume requirements under conventional operating systems. Instead, some form of embedded process control program may be required on the node computers. Author

N87-25891*# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
GENERAL PURPOSE ALGORITHMS FOR CHARACTERIZATION OF SLOW AND FAST PHASE NYSTAGMUS c52
Charles S. Lessard *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 31 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 31 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 06P

In the overall aim for a better understanding of the vestibular and optokinetic systems and their roles in space motion sickness, the eye movement responses to various dynamic stimuli are measured. The vestibulo-ocular reflex (VOR) and the optokinetic response, as the eye movement responses are known, consist of slow phase and fast phase nystagmus. The specific objective is to develop software programs necessary to characterize the vestibulo-ocular and optokinetic responses by distinguishing between the two phases of nystagmus. The overall program is to handle large volumes of highly variable data with minimum operator interaction. The programs include digital filters, differentiation, identification of fast phases, and reconstruction of the slow phase with a least squares fit such that sinusoidal or psuedorandom data may be processed with accurate results. The resultant waveform, slow phase velocity eye movements, serves as input data to the spectral analysis programs previously developed for NASA to analyze nystagmus responses to pseudorandom angular velocity inputs. Author

N87-25892*# Clemson Univ., S.C. Dept. of Ceramic Engineering.
LUNAR COMPOSITE PRODUCTION Interim Report c91
William Lewis *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 14 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 14 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 03B

A minimally processed composite material derived from lunar soil and possessing tensile strength is described. Laboratory work and the direction of future work are discussed. Author

N87-25893*# Houston Univ., Tex. Dept. of Natural Sciences.
AN EVALUATION OF TURBO PROLOG WITH AN EMPHASIS ON ITS APPLICATION TO THE DEVELOPMENT OF EXPERT SYSTEMS c61
Richard B. Loftin *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 13 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 13 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 09B

Turbo Prolog is a recently available, compiled version of the programming language Prolog. Turbo Prolog is designed to provide not only a Prolog compiler, but also a program development environment for the IBM Personal Computer family. An evaluation of Turbo Prolog was made, comparing its features to other versions of Prolog and to the community of languages commonly used in artificial intelligence (AI) research and development. Three programs were employed to determine the execution speed of Turbo Prolog applied to various problems. The results of this evaluation demonstrated that Turbo Prolog can perform much better than many commonly employed AI languages for numerically intensive problems and can equal the speed of development languages such as OPS5+ and CLIPS, running on the IBM PC. Applications for which Turbo Prolog is best suited include those which (1) lend themselves naturally to backward-chaining approaches, (2) require extensive use of mathematics, (3) contain few rules, (4) seek to make use of the window/color graphics capabilities of the IBM PC, and (5) require linkage to programs in other languages to form a complete executable image. Author

N87-25894*# Houston Univ., Tex. Dept. of Electronics.
TRANSVERSE DIFFUSION OF ELECTRONS IN A MAGNETOPLASMA c75
Bernard McIntyre *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, volume 2 Jun. 1987 11 p (For primary document see Summer Faculty Fellowship Program, 1986, volume 2 11 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 20I

Plasma density and temperature profiles were measured for plasma electrons which were generated by a plasma source and ionization from a 1 kev electron beam. Electron plasma parameters were measured with a cylindrical Langmuir probe which was moved perpendicular to the axis of the beam and field. Electron densities decreased exponentially from the beam center and the decay constant varied with magnetic field in accordance with the Bohm theory of cross field diffusion. This enhanced diffusion effect due to instabilities generated by the electron beam is orders of magnitude larger than that due to particle collisions. Author

N87-25895*# South Carolina Univ., Columbia. Dept. of Mechanical Engineering.
HIGH TEMPERATURE ELECTROLYZER/FUEL CELL POWER CYCLE: PRELIMINARY DESIGN CONSIDERATIONS c44
Jeffrey H. Morehouse *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 45 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 45 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 10B

A model of a high temperature electrolyzer/fuel cell, hydrogen/oxygen, thermally regenerative power cycle is developed and used to simulate system performance for varying system parameters. Initial estimates of system efficiency, weight, and volume are provided for a one KWe module assuming specific electrolyzer and fuel cell characteristics, both current and future. Specific interest is placed on examining the system responses to changes in device voltage versus current density operating curves, and the associated optimum operating ranges. The performance of a solar-powered, space based system in low earth orbit is examined in terms of the light-dark periods requiring storage. The storage design tradeoffs between thermal energy, electrical energy, and hydrogen/oxygen mass storage are examined. The current technology module is based on the 1000 C solid oxide electrolyzer cell and the alkaline fuel cell. The Future Technology system examines benefits involved with developing a 1800K electrolyzer operating with an advanced fuel cell. Author

N87-25896*# Texas Univ., Austin. Dept. of Occupational Health.
EVALUATION OF AN AUTOMATED KARYOTYPING SYSTEM FOR CHROMOSOME ABERRATION ANALYSIS c51
Howard M. Prichard *In* NASA. Lyndon B. Johnson Space Center,

National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 10 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 10 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 06B

Chromosome aberration analysis is a promising complement to conventional radiation dosimetry, particularly in the complex radiation fields encountered in the space environment. The capabilities of a recently developed automated karyotyping system were evaluated both to determine current capabilities and limitations and to suggest areas where future development should be emphasized. Cells exposed to radiometric chemicals and to photon and particulate radiation were evaluated by manual inspection and by automated karyotyping. It was demonstrated that the evaluated programs were appropriate for image digitization, storage, and transmission. However, automated and semi-automated scoring techniques must be advanced significantly if in-flight chromosome aberration analysis is to be practical. A degree of artificial intelligence may be necessary to realize this goal. Author

N87-25897*# University of Southeastern Louisiana, Hammond. Dept. of Biological Sciences.
GENETIC TOXICITY STUDIES OF ORGANIC CHEMICALS FOUND AS CONTAMINANTS IN SPACECRAFT CABIN ATMOSPHERES **c54**
Joseph Torres, Jr. *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 14 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 14 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 06K

Astronauts can be exposed during spaceflight to organic chemical contaminants in the spacecraft cabin atmosphere. Toxic exposures may cause lesions in the cellular DNA which are subsequently expressed as sister-chromatid exchanges (SCE). Analysis of SCE is a sensitive short term assay techinque to detect and quantitate exposures to DNA damaging (mutagenic) substances. The increase in SCE incidence over baseline (control) levels is generally proportional to the concentration of the mutagen and to the duration of exposure. The BHK-21 baby hamster kidney cell line was the in vitro test system used. Test organics were added to the culture media for 18 hrs, in concentrations ranging from one to 20 ppm. Acetaldehyde and carbon disulfide were chosen for this study since they have occurred as atmospheric contaminants in many of the STS flights, and have been reported to have toxic and mutagenic effects in various test systems. Glutaraldehyde was chosen because few data are available on the mutagenicity of this common fixative, which is carried on STS flights for use in biological experiments. Acetaldehyde was a very strong inducer of SCE at concentrations of 2 ppm and above. Glutaraldehyde and carbon disulfide failed to induce SCE.
Author

N87-25898*# Prairie View Agricultural and Mechanical Coll., Tex.
AFFIRMATIVE ACTION AS ORGANIZATION DEVELOPMENT AT THE JOHNSON SPACE CENTER **c81**
Mfanya Donald L. Tryman *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 34 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 34 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 05A

The role of affirmative actions is investigated as an interventionist Organization Development (OD) strategy for insuring equal opportunities at the NASA/Johnson Space Center. In doing so, an eclectic and holistic model is developed for the recruiting and hiring of minorities and females over the next five years. The strategy, approach, and assumptions for the model are quite different than those for JSC's five year plan. The study concludes that Organization development utilizing affirmative action is a valid means to bring about organizational change and renewal processes, and that an eclectic model of affirmative action is most suitable and rational in obtaining this end. Author

N87-25899*# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Electrical Engineering.
ANALYSIS OF THE CONTINUOUS STELLAR TRACKING ATTITUDE REFERENCE (CSTAR) ATTITUDE RATE PROCESSOR **c12**
J. Uhde-Lacovara *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 29 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 29 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 22A

The Continuous Stellar Tracking Attitude Reference (CSTAR) system is an in-house project for Space Station to provide high accuracy, drift free attitude and angular rate information for the GN&C system. The outputs of the solid state star trackers are processed to provide attitude information; rate data is then derived from the attitude. Rate derivation is based on discrete time polynomial approximation techniques. This gives simple algorithms which allow for interpolation by other users. Attitude rate is modeled as a constant with low amplitude, low frequency sinusoids superimposed. The rate processor is parameterized to account for the effects of random errors, sample rate, data processing rate and perturbation frequency. The baseline system may be characterized as follows: the three sigma attitude accuracy is 0.01 degrees, the three sigma rate accuracy is 0.0001 degrees per second, the sample rate is 100 Hertz, the sampled signal is bandlimited to 0.5 Hertz, and the data processing rate is 10 Hertz. The above system requires a differentiator of length 127. This will track rate perturbations of frequencies less than 0.01 Hertz with low systematic errors. Author

N87-25900*# Houston Univ., Tex. Dept. of Human Development.
BONE DENSITY IN LIMB-IMMOBILIZED BEAGLES: AN ANIMAL MODEL FOR BONE LOSS IN WEIGHTLESSNESS **c52**
Ira Wolinsky *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 6 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 6 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 06B

Prolonged weightlessness is man in space flight results in a slow progressive demineralization of bone accompanied by an increased calcium output in the urine resulting in negative calcium balances. This possibly irreversible bone loss may constitute a serious limiting factor to long duration manned space flight. In order to seek and test preventative measures an appropriate ground based animal model simulating weightlessness is necessary. Use of the mature Beagle in limb immobilization has been documented as an excellent model for orthopedic research since this animal most closely simulates the phenomenom of bone loss with regards to growth, remodeling, structure, chemistry and mineralization. The purpose of this project is to develop a research protocol for the study of bone loss in Beagles during and after cast immobilization of a hindleg; research will then be initiated. Author

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N87-25901*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
US ATLAS OF OPTICAL TELESCOPES, 2ND EDITION
Stephen Paul Meszaros Mar. 1987 22 p
(NASA-TM-88283; H-1397; NAS 1.15:88283) Avail: NTIS HC A02/MF A01 CSCL 03A

This atlas shows the locations of and gives information about optical telescopes used for astronomical research in the United States as of late 1986. Those instruments with mirror or lens diameters of 3/4 m (approx. 30 inches) and larger are included. These telescopes are concentrated in the Southwest, on the West Coast and on the island of Hawaii. Author

N87-25902*# Eastman Kodak Co., Rochester, N. Y. US Apparatus Div.
UPRATED FINE GUIDANCE SENSOR STUDY Final Report
17 Oct. 1984 180 p
(Contract NAS8-35504)
(NASA-CR-179129; NAS 1.26:179129; GP-00816) Avail: NTIS HC A09/MF A01 CSCL 03A

Future orbital observatories will require star trackers of extremely high precision. These sensors must maintain high pointing accuracy and pointing stability simultaneously with a low light level signal from a guide star. To establish the fine guidance sensing requirements and to evaluate candidate fine guidance sensing concepts, the Space Telescope Optical Telescope Assembly was used as the reference optical system. The requirements review was separated into three areas: Optical Telescope Assembly (OTA), Fine Guidance Sensing and astrometry. The results show that the detectors should be installed directly onto the focal surface presented by the optics. This would maximize throughput and minimize point stability error by not incoporating any additional optical elements. B.G.

N87-25903*# Washington Univ., Seattle. Dept. of Astronomy.
OBSERVATIONS MADE WITH THE INTERNATIONAL ULTRAVIOLET EXPLORER Final Technical Report
Bruce Margon 28 Jul. 1987 7 p
(Grant NsG5-342)
(NASA-CR-181117; NAS 1.26:181117) Avail: NTIS HC A02/MF A01 CSCL 03A

Observations were made with the International Ultraviolet Explorer of two quite diverse astronomical objects. The first is an extremely ultraviolet excess star projected near the globular cluster M5. The second is a previously unrecognized but very bright starburst galaxy. Each of these objects is discussed in detail. Author

N87-25904*# Dartmouth Coll., Hanover, N.H. Dept. of Physics and Astronomy.
ULTRAVIOLET SPECTRA OF TWO MAGNETIC WHITE DWARFS AND ULTRAVIOLET SPECTRA OF SUBLUMINOUS OBJECTS FOUND IN THE KISO SCHMIDT SURVEY Semiannual Report, 1 Jan. - 30 Jun. 1987
Gary A. Wegner 28 Jul. 1987 14 p
(Grant NAG5-287)
(NASA-CR-181122; NAS 1.26:181122) Avail: NTIS HC A02/MF A01 CSCL 03A

Low resolution International Ultraviolet Explorer (IUE) spectroscopic observations of two magnetic white dwarfs BPM25114 and K813-14 were obtained using both the SWP and LWP cameras. The first object has an observed magnetic field of 4 x 10(7) Gauss and the second has one of 3 x 10(7) Gauss. Both objects have overall spectral energy distributions appropriate for cool DA white dwarfs with T(eff) near 10,000 K and accordingly show strong lambda lambda 1400 and 1600 absorption in their spectra. Compared to non-magnetic DA white dwarfs of comparable effective temperature, there are some differences in the profiles, presumably produced by the magnetic fields in these objects. In addition, the ultraviolet spectra of a number of hot subluminous stars in the Kiso Schmidt survey were observed. M.G.

N87-25905*# Boston Univ., Mass. Dept. of Astronomy.
THEORETICAL INTERPRETATION OF THE HEAO-3 OBSERVATIONS OF CYGNUS X-3 UNDER THE HEAO-3 GUEST INVESTIGATOR PROGRAM Final Technical Report, 1 Jul. 1985 - 30 Jun. 1987
Alan P. Marscher 29 Jul. 1987 9 p
(Grant NAG8-537)
(NASA-CR-181171; NAS 1.26:181171) Avail: NTIS HC A02/MF A01 CSCL 03A

A model of the galactic X-ray source Cygnus X-3 (Cyg X-3) is presented which deviates from previous models by positing that the X-rays originate in a jet rather than a binary system consiting of an ordinary star and a collapsed object. In the new model, the 4.8 hour period of Cyg X-3 is caused by variable absorption which occurs as the jet precesses. The primary role of the accretion disk corona (ADC) in modulating Cyg X-3 radiation is to make the observed intensity of a blob of material in a jet appear dimmer by absorption. The needed derivation of the positional dependence of the density of the ADC is freed of some complications by assuming that only the inner regions of the disk are precessing, with a period shorter than 4.8 hours. This model permits the secondary star to be a supergiant, as indicated by the luminosity of the system. The model is especially helpful in interpreting production of radio outbursts and very high energy gamma rays. J.P.B.

N87-25906*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FIFTY YEAR CANON OF SOLAR ECLIPSES: 1986 - 2035
Fred Espenak Jul. 1987 272 p
(NASA-RP-1178-Rev; Rept-87B0252; NAS 1.61:1178-Rev) Avail: NTIS HC A12/MF A01 CSCL 03A

A complete catalog is presented, listing the general characteristics of every solar eclipse from 1901 through 2100. To complement this catalog, a detailed set of cylindrical projection world maps shows the umbral paths of every solar eclipse over the 200 year interval. Focusing in on the next 50 years, accurate geodetic path coordinates and local circumstances for the 71 central eclipses from 1987 through 2035 are tabulated. Finally, the geodetic paths of the umbral and penumbral shadows of all 109 solar eclipses in this period are plotted on orthographic projection maps of the Earth. Appendices are included which discuss eclipse geometry, eclipse frequency and occurrence, modern eclipse prediction and time determination. Finally, code for a simple Fortran program is given to predict the occurrence and characteristics of solar eclipses. Author

N87-25409# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
INFLIGHT EXPERIENCE WITH THE ESA STARMAPPER DURING THE GIOTTO MISSION
J. Fertig *In its* Proceedings of the Second International Symposium on Spacecraft Flight Dynamics Dec. 1986 p 421-427 (For primary document see N87-25354 19-18)
Copyright Avail: NTIS HC A22/MF A01

N87-25500# Joint Publications Research Service, Arlington, Va.
CLIMATIC TEST BENCH FOR STRUCTURAL ELEMENTS OF PARABOLIC REFLECTORS
Yu. R. Bapbyyev, M. A. Gurbanyazov, I. S. Lisker, and M. Khandurdyyev *In its* USSR Report: Engineering and Equipment 18 Feb. 1987 p 51-56 Transl. into ENGLISH from Izvestiya Akademii Nauk Turkmenskoy SSR: Seriya Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk (Ashkhabad, USSR), no. 1, Jan. - Feb. 1986 p 20-24 (For primary document see N87-25497 19-31)
Copyright Avail: NTIS HC A05/MF A01

N87-25920# Kent Univ., Canterbury (England). Unit for Space Sciences.
THE UKIRT INFRARED OBSERVATIONAL PROGRAMME
S. F. Green, J. A. M. McDonnell, G. S. A. Pankiewicz, and J. C. Zarnecki *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 81-86 Sponsored by the UK Science and Engineering Research Council (For primary document see N87-25908 19-90)
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N87-25970# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Hauptabteilung Angewandte Datentechnik.
DETAILED ANALYSIS OF A SURFACE FEATURE ON COMET HALLEY
G. Schwarz, H. Craubner, A. Delamere, M. Goebel, M. Gonano, W. F. Huebner, H. U. Keller, R. Kramm, E. Mikusch, H. Reitsema (Ball Aerospace Systems Div., Boulder, Colo.) et al. *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 371-374 (For primary document see N87-25908 19-90)
Copyright Avail: NTIS HC A20/MF A01; print copy avail. from EPD, ESTEC, Noordwijk, The Netherlands Dfl 175 (3 volumes)
CSCL 00/64

N87-25971# Consiglio Nazionale delle Ricerche, Frascati (Italy). Inst. di Fisica dello Spazio Interplanetario.
GROUNDBASED CCD-OBSERVATIONS OF COMET HALLEY WITH THE GIOTTO-HMC-FILTERS
C. B. Cosmovici, S. F. Green, D. W. Hughes, H. U. Keller, P. Mack, E. Moreno-Insertis, and H. U. Schmidt (Max-Planck-Inst. fuer Physik und Astrophysik, Garching, West Germany) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 375-379 Sponsored by CNR and the Science and Engineering Research Council Original contains color illustrations (For primary document see N87-25908 19-90)
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90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics*.

N87-25907# Chicago Univ., Ill.
NEUTRINO COUNTING WITH THE SUPERNOVA AND THE BIG BANG
D. N. Schramm Apr. 1987 10 p Presented at the 22nd Recontres de Moriond: Electroweak Interactions and Unified Theories Conference, Les Arcs, France, 8 Mar. 1987 Prepared in cooperation with Fermi National Accelerator Lab., Batavia, Ill.
(Contract DE-AC02-76CH-03000)
(DE87-009492; FNAL/C-87/70A; CONF-870390-2) Avail: NTIS HC A02/MF A01

It is shown that the recent supernova in the Large Magellanic Cloud can be used to set a limit on the number of neutrino families to less than 7. For comparison the standard Big Bang nucleosynthesis arguments are reviewed. Using the primordial Helium as inferred from the He versus C correlations, and using the strengthened Li constraint, the cosmological limit is tightened such that three (or two) neutrino families fit well, but a fourth is beginning to be questionable, although it cannot be totally excluded. DOE

N87-25908# European Space Agency, Paris (France).
PROCEEDINGS OF THE 20TH ESLAB SYMPOSIUM ON THE EXPLORATION OF HALLEY'S COMET. VOLUME 2: DUST AND NUCLEUS
B. Battrick, ed., E. J. Rolfe, ed., and R. Reinhard, ed. Dec. 1986 474 p Symposium held in Heidelberg, West Germany, 27-31 Oct. 1986; sponsored by the Inter-Agency Consultative Group, the International Halley Watch, COSPAR, and the International Astronomical Union Original contains color illustrations
(ESA-SP-250-Vol-2; ISSN-0379-6566; ETN-87-99859) Copyright Avail: NTIS HC A20/MF A01; print copy avail. from EPD, ESTEC, Noordwijk, The Netherlands Dfl 175 (3 volumes)

The Giotto, Vega, Sakigake, Suise, and ICE flyby missions to comets Halley and Giacobini-Zinner, and ground-based observations of dust and nucleus phenomena were discussed. For individual titles, see N87-25909 through N87-25981.

N87-25909# Academy of Sciences (USSR), Leningrad. A. F. Ioffe Technical Inst. of Physics.
DUST IN COMET HALLEY FROM VEGA OBSERVATIONS
E. P. Mazets, R. Z. Sagdeev, R. L. Aptekar, S. V. Golenetskii, Yu. A. Guryan, A. V. Dyachkov (Academy of Sciences, USSR, Moscow), V. N. Ilyinskii, V N. Panov, G. G. Petrov, A. V. Savvin et al. *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 3-10 (For primary document see N87-25908 19-90)
Copyright Avail: NTIS HC A20/MF A01; print copy avail. from EPD, ESTEC, Noordwijk, The Netherlands Dfl 175 (3 volumes)

The SP-2 experiment on Vega studied the spatial and mass distributions of dust particles in the cometary coma over the mass range from 10 to the minus 16th to minus 6th power g. Results support the concept developed by Whipple (1950) of a cometary nucleus being an aggregate of ices and solid particles, as well as the major guidelines of the cometary models constructed when preparing the missions. The principal unexpected results of measurements on Vega spacecraft are the discovery of a high number density of the smallest dust particles, of a very narrow angular pattern in the dust emission from the nucleus, and of the variability in the dust particle mass distribution at different distances from the nucleus. ESA

N87-25910# Chicago Univ., Ill. Enrico Fermi Inst.
HALLEY'S COMET DUST PARTICLE MASS SPECTRA, FLUX DISTRIBUTIONS AND JET STRUCTURES DERIVED FROM MEASUREMENTS ON THE VEGA-1 AND VEGA-2 SPACECRAFT
J. A. Simpson, D. Rabinowitz, A. J. Tuzzolino, L. V. Ksanfomality, and R. Z. Sagdeev (Academy of Sciences, USSR, Moscow) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 11-16 (For primary document see N87-25908 19-90)
(Contract NASw-3959)
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The spatial and temporal distributions of Halley coma dust particles with masses greater than 10 to the minus 13th power g are confirmed and extended to reveal additional properties of the coma. The reported inverse square dependence of flux with distance from the nucleus shows well-defined envelope boundaries. Regions of enhanced fluxes inside these boundaries are identified as dust jets, one of which, observed near closest approach for Vega-1, was analyzed. Tracing dust jets back to the nucleus shows a strong correlation with the active jet regions predicted by Sekanina and Larson (1986). Clusters and packets of dust particles, each containing wide ranges of masses and numbers of particles, are discovered, especially in the fringe regions of the coma. ESA

N87-25911# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
SPATIAL DISTRIBUTION OF LOW-MASS DUST PARTICLES (m LESS THAN OR = 10 TO THE MINUS 10TH POWER g) IN COMET HALLEY COMA
O. Vaisberg, V. Smirnov, and A. Omelchenko *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 17-23 (For primary document see N87-25908 19-90)

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Spatial distribution of cometary dust particles in the mass range from 10 to the minus 10th to minus 16th power g was obtained with plasma impact detector SP-1 on Vega-1 and 2. Mass spectrum continues to rise below 10 to the minus 14th power g. Selective light absorption influences 10 to the minus 17th to minus 14th power g particles throughout the radial interval 10,000 to 210,000 km. Existence of several dust paraboloids is suggested with different properties of grains. Evidence of evolution of grains is found. Spatial dispersion of mass in distinct dust jets observed on Vega-2 is used to evaluate the dust velocity dispersion and to associate the motion of particles with the rotation of nucleus. ESA

N87-25912# Kent Univ., Canterbury (England). Unit for Space Sciences.

GIOTTO'S DUST IMPACT DETECTION SYSTEM (DIDSY) AND PARTICULATE IMPACT ANALYZER (PIA): INTERIM ASSESSMENT OF THE DUST DISTRIBUTION AND PROPERTIES WITHIN THE COMA

J. A. M. McDonnell, J. Kissel, E. Gruen, R. J. L. Grard, Y. Langevin (Paris-Sud Univ., Orsay, France), R. E. Olearczyk, C. H. Perry, and J. C. Zarnecki *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 25-38 Sponsored by the UK Science and Engineering Research Council and BMFT (For primary document see N87-25908 19-90)

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In-situ detectors aboard Giotto recorded the discrete impact of particulates from 287,000 km pre-encounter to 202,000 km postencounter. Mass sensitive detectors determined the intercepted particulate flux at 68 km/sec enabling the mass distribution upwards of 10 to the minus 19th power g to be determined. Flux data are combined to assess the dust distribution over this mass range and its spatial variation. Properties relating to the geometrical area and mass of the distributions along Giotto's 605 km intercept trajectory are derived and are transformed to the nucleus surface to assess overall mass output rates and activity variations. A bimodal particle distribution (in terms of an abrupt index change) is demonstrated to exist within the coma. Data yield full agreement with the mass required to decelerate the spacecraft but imply a relatively large population of massive particles surrounding Halley which would not be detected by optical sensing. ESA

N87-25913# Observatoire de Paris-Meudon (France).

COMET HALLEY: DUST CHARACTERIZATION BY PHOTOPOLARIMETRY

Audouin Dollfus, Jean-Luc Suchail, Daniel Crussaire, and Reiner Killinger (Ruhr Univ., Bochum, West Germany) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 41-45 (For primary document see N87-25908 19-90)

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Dust in the coma and tail of P/Halley have been charaterized by polarimetry. The variation in the degree of polarization in the coma with phase angle and with wavelengths is compatible with dust grains made of aggregates of very dark small particles, with an albedo of 3% to 4% almost independent of wavelength between 370 and 600 nm. Circular polarization and deflection in the azimuth of polarization were investigated in terms of isotropies in the aggregates. The inner part of the coma close to the nucleus, very bright, produces a polarization which significantly departs from the coma and may involve other kinds of particles, not necessary aggregates. ESA

N87-25914# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth, Atmospheric and Planetery Sciences.

SCATTERING PROPERTIES OF COMETARY GRAINS: COMET P/HALLEY

D. C. Jewitt and K. J. Meech *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 47-51 (For primary document see N87-25908 19-90)

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Two ground based investigations into the scattering properties of cometary grains are reported. Spectral observations at a resolution of 20A show that the optical reflectivity of the continuum increases with wavelength. However, the reflectivity gradients decrease with increasing wavelength, the scattering becoming neutral near 2.5 microns, and blue at 2.5 microns. Optical and near infrared data are consistent with the scattering expected from power law grain size distributions with cross section weighted mean radii greater than 1 micron. The optical continuum of comet P/Halley is reddened with respect to the Sun by 10 + or - 2%/1000A, placing P/Halley within the range of other comets in terms of its continuum colors. The reflectivity gradient in P/Halley is a function of position in the coma. The grain coma on the sunward side of the nucleus is redder than on the tailward side. The rate of change of the reflectivity gradient with respect to distance along the tail axis is 0.01% per 1000A per arcsec. Grain size sorting by solar radiation pressure is indicated. ESA

N87-25915# Ruhr Univ., Bochum (West Germany). Bereich Extraterrestrische Physik.

ALBEDO AND COLOR OF DUST GRAINS: LABORATORY VERSUS COMETARY RESULTS

R. H. Giese, R. T. Killinger, B. Kneissel, and R. H. Zerull *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 53-57 Sponsored by Deutsche Forschungsgemeinschaft and BMFT (For primary document see N87-25908 19-90)

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Laboratory laser and microwave scattering experiments show that absorbing irregular and fluffy dust grains can have low (less than or = 0.05) geometric albedos and that they can produce color effects, which have to be taken into account in interpretation of photometric Halley measurements. Therefore modeling exclusively by Mie theory is dangerous, since the scattering properties of large irregular particles deviate from that of smooth spheres. ESA

N87-25916# Kanazawa Inst. of Tech. (Japan).

ROLE OF SMALL GRAINS IN THE VISIBLE POLARIZATION OF COMET HALLEY

T. Mukai, S. Mukai, and S. Kikuchi (Tokyo Astronomical Observatory, Mitaka, Japan) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 59-63 (For primary document see N87-25908 19-90)

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Visible polarimetry of Comet Halley over the phase angle alpha from 1.6 to 64.4 deg was made by an 8 channel polarimeter. Negative values of the polarization p in alpha less than 20 deg and linear increase of p with alpha are found. A slight increase of p with wavelength is likely. Observed alpha dependence of p leads to the average optical constants (m=n-i k) of grain materials; n=1.39 + or - 0.01 and k=0.035 + or - 0.004, where the grains have the size spectrum reported by the Vega mission. Model calculations suggest that small grains with radii less than 1 micron play an essential role in the polarization of comets. ESA

N87-25917# Max-Planck-Inst. fuer Kernphysik, Heidelberg (West Germany).

COMET HALLEY: IMPLICATIONS OF THE IMPACT MEASUREMENTS FOR THE OPTICAL PROPERTIES OF THE DUST

P. L. Lamy and J.-M. Perrin (Laboratoire d'Astronomie Spatiale, Marseille, France) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust

and Nucleus Dec. 1986 p 65-68 (For primary document see N87-25908 19-90)
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The cumulative mass flux function obtained by Vega 2 SP-2 impact instrument is used to calculate the brightness integral for grains of various compositions, in the framework of Mie theory and of a model for light scattering by rough grains. Polarization for large scattering angles and color in the ultraviolet and visible range are also obtained. The results are compared with the space and ground-based observations. General indications on the properties of cometary dust are outlined. ESA

N87-25918# Max-Planck-Inst. fuer Kernphysik, Heidelberg (West Germany).
THE DUST TAIL OF COMET HALLEY: BRIGHTNESS, COLOR, POLARIZATION
P. Lamy, H. Pedersen, and R. Vio (European Southern Observatory, La Silla, Chile) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 69-72 (For primary document see N87-25908 19-90)
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Images of the dust tail of comet Halley were obtained with the ESO wide-field CCD camera during April 1986 with the Johnson B, V, and R filters in polarized light. An analysis of selected images taken on April 6 and 11, processed for photometric analysis, is presented. Results for absolute brightness, color, polarization and its variation with wavelength are given. ESA

N87-25919*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ALBEDO MAPS OF COMETS P/GIACOBINI-ZINNER AND P/HALLEY
H. B. Hammel, A. D. Storrs, D. P. Cruikshank, C. M. Telesco, R. M. Decher, and H. Campins (Planetary Science Inst., Tucson, Ariz.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 73-76 (For primary document see N87-25908 19-90)
(Grants NGL-12-001-057; NSF AST-84-14737)
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CSCL 03B

Near-simultaneous infrared and visual maps of P/Giacobini-Zinner (P/G-Z) and P/Halley are combined to create maps of the spatial variation of geometric albedo. Giacobini-Zinner shows a minimum in albedo near 0.07 with an increase of a factor of 2 over 30 arcsec. The lowest albedos are offset from the nucleus in the antisunward direction, coincident with a dust tail observed in the IR. The P/Halley albedos are higher than those for P/G-Z and range from 0.2 to 0.4, but the trend of darker albedo in the antisunward direction (along the tail) is the same. The albedo distribution is attributed to large, dark, fluffy grains confined to the orbital plane close to the nucleus. The high albedo values in P/Halley may be due to enhanced flux in the visual image because of the comet's very small phase angle. ESA

N87-25920# Kent Univ., Canterbury (England). Unit for Space Sciences.
THE UKIRT INFRARED OBSERVATIONAL PROGRAMME c89
S. F. Green, J. A. M. McDonnell, G. S. A. Pankiewicz, and J. C. Zarnecki *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 81-86 Sponsored by the UK Science and Engineering Research Council (For primary document see N87-25908 19-90)
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Using the 3.8m United Kingdom Infrared Telescope on Mauna Kea, Hawaii, infrared observations of Comet P/Halley were planned for the whole of its apparition. In December 1984 the first infrared detection was made indicating the presence of a dust coma at over 5 AU. Since then a program of infrared photometry and mapping from 1 to 20 microns and spectroscopy and polarimetry to characterize the properties of the dust comae of P/Halley and P/Giacobini-Zinner continued. Observations are discussed with reference to the observational and calibration problems associated with infrared photometry of comets. ESA

N87-25921# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
NEAR-INFRARED STUDIES OF COMET HALLEY: POLARIZATION AND COLOR
T. Y. Brooke, R. F. Knacke, and R. R. Joyce (Kitt Peak National Observatory, Tucson, Ariz.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 87-89 (For primary document see N87-25908 19-90)
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The linear polarization and color of comet Halley in broadband filters J(1.25 microns), H(1.65 microns) and K(2.2 microns) were measured at phase angles (beta) between 9.4 and 65.3 deg from Sept. 1985 to May 1986. Halley exhibits a red color characteristic of comet dust at these wavelengths with no clear variation with Beta. The JHK polarizations reach 25% at the largest Beta with a reversal at 20 deg and negative polarizations of a few per cent at smaller Beta. The polarization increases with wavelength at the larger phase angles. Models of the near-infrared polarization versus phase angle for comet West fail to match the present observations. Calculations of polarization incorporating two components and power-law grain size distributions provide better agreement. ESA

N87-25922*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMAL INFRARED IMAGING OF COMET HALLEY
H. Campins (Planetary Science Inst., Tucson, Ariz.), C. M. Telesco, R. Decher, and B. D. Ramsey *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 91-93 (For primary document see N87-25908 19-90)
(Grant NSF AST-84-14737)
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Thermal infrared images (10.8, 12.8, and 19.2 microns) of comet Halley were obtained on 1986 Mar. 28.7, 29.7 and 30.7 UT using the NASA-MSFC 20-pixel bolometer array at the NASA Infrared Telescope Facility. Analysis of the observations shows: the presence of spatial structure indicative of dust ejection occurring mainly on the sunward side of the nucleus; a dust coma deficient in large particles (radius greater than 100 microns) compared with that of Comet P/Giacobini-Zinner, temporal variability consistent with an extrapolation of a quasi-sinusoidal light curve observed by IUE on 1986 March 23, 24, and 25; and a maximum at the nuclear condensation of the color temperature and the strength of the silicate emission feature. ESA

N87-25923# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
THE 3.2-3.6 MICRON EMISSION FEATURES IN COMET HALLEY. COMPARISON WITH INTERSTELLAR AND LABORATORY SPECTRA
R. F. Knacke, T. Y. Brooke, and R. R. Joyce (Kitt Peak National Observatory, Tucson, Ariz.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 95-99 (For primary document see N87-25908 19-90)
(Grant NSF AST-84-14825)
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Ground-based spectroscopic observations of emission features discovered in comet Halley by the Vega-1 spacecraft are reported.

At a resolution of 0.012 the emission consists of several components between 3.2 and 3.6 microns and appears to be superpositions of C-H group bands. Molecular or small particle emission seem possible, but not emission coupled to the 4 to 20 emitter. High abundances are required unless the emission is from hot (T greater than 400 K) grains. The band shape differs from those of suspected interstellar emitting substances in having strong features longward of characteristic C-H bands. This structure may be due to alkyl side-chains characteristic of low formation temperatures. The band resembles, but is not identical to interstellar absorptions near 3.4 microns. ESA

N87-25924*# Minnesota Univ., Minneapolis.
INFRARED TEMPORAL DEVELOPMENT OF P/HALLEY
R. D. Gehrz and E. P. Ney *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 101-105 Sponsored by NASA, Minnesota Univ. Inst. of Technol. Dean's Office and Graduate School, and Wyoming Univ. (For primary document see N87-25908 19-90)
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Halley's comet was observed at 0.7 to 23 microns with several diaphragms and beam throws on over 30 occasions between 1985 Dec. 12 and 1986 May 6. Several times, once within hours of perihelion, simultaneous measurements were made with different beam sizes using telescopes in Minnesota and Wyoming. Halley has an average dust albedo of 12% at 120 deg scattering angle. There is no evidence for strong backscattering in the phase function to angles of 165 deg. The 10 microns silicate signature is always present but varies in strength for heliocentric distances less than 1 AU. It is absent at distances greater than 1 AU. The dust albedo appears to decrease when the silicate feature is weak. Halley's infrared intensity fluctuates by a factor of 7 on timescales of 1 to 2 days. The variations suggest jet-like activity associated with nuclear rotation. ESA

N87-25925*# Planetary Science Inst., Tucson, Ariz.
AIRBORNE PHOTOMETRY OF COMET HALLEY FROM 40 TO 160 MICRONS
H. Campins, M. Joy, P. M. Harvey, D. F. Lester, and H. B. Ellis, Jr. (Texas Univ., Austin.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 107-109 (For primary document see N87-25908 19-90)
(Contract NAS2-12323; Grant NAG2-67)
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Far infrared photometry of comet Halley was obtained from NASA's Kuiper Airborne Observatory. The brightness of the comet decreases by nearly a factor of two on the second day in phase with the variability observed in blue light by IUE during the same time period. The energy distribution also varies significantly with a shallower (cooler) spectrum on the second day indicating fewer small particles on that day. Observations 30 and 60 arcsec away from the nuclear condensation show lower 50 to 100 microns color temperatures on both dates. This is consistent with observations by Giotto and Vega which indicate a higher proportion of large particles away from the nucleus. ESA

N87-25926*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AIRBORNE SPECTROPHOTOMETRY OF P/HALLEY FROM 20 TO 65 MICRONS
W. Glaccum, S. H. Moseley, H. Campins, and R. F. Loewenstein (Chicago Univ., Ill.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 111-116 (For primary document see N87-25908 19-90)
(Contract NAS2-12323)
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Simultaneous 20 to 65 microns spectrometry and 100 microns photometry of P/Halley obtained on board the Kuiper Airborne Observatory (KAO) in 1985 Dec. and 1986 April are discussed. Spectra with resolution 30 to 50 were obtained with the NASA/Goddard 24 channel grating spectrometer. Measurements were made on the nucleus as well as 5 points along and perpendicular to the Sun-tail direction. The observations reveal the absence of any strong spectral features. The color temperature of the dust varies over time scales as short as 2 days, but is higher than that expected for a rapidly rotating blackbody at the same distance from the Sun. The color temperature does not vary within 1 arcmin of the nucleus, but the coma is brighter on the sunward side than on the antisunward side. ESA

N87-25927*# Cornell Univ., Ithaca, N.Y.
AIRBORNE SPECTROPHOTOMETRY OF P/HALLEY FROM 16 TO 30 MICRONS
T. Herter, G. E. Gull, and H. Campins (Planetary Science Inst., Tucson, Ariz.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 117-120 (For primary document see N87-25908 19-90)
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CSCL 03B

Comet Halley was observed in the 16 to 30 micron region using the Cornell University 7-channel spectrometer (resolution = 0.02) on board the Kuiper Airborne Observatory on 1985 Dec. 14.2. A 30-arcsec aperture (FWHM) was used. Measurements centered on the nuclear condensation micron indicate that if present, the 20 micron silicate feature is very weak, and that a relatively narrow strong feature centered at 28.4 microns possibly exists. However, this feature may be an artifact of incomplete correction for telluric water vapor absorption. ESA

N87-25928*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AIRBORNE SPECTROPHOTOMETRY OF COMET HALLEY FROM 5 TO 9 MICRONS
H. Campins, J. D. Bregman, F. C. Witteborn, D. H. Wooden, D. M. Rank, L. J. Allamandola, M. Cohen, and A. G. G. M. Tielens (California Univ., Berkeley.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 121-124 (For primary document see N87-25908 19-90)
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Spectrophotometry from 5 to 9 microns (resolution = 0.02) of comet Halley was obtained from the Kuiper Airborne Observatory on 1985 Dec. 12.1 and 1986 April 8.6 and 10.5 UT. Two spectral features are apparent in all the observations, one from 5.24 to 5.6 microns, and the silicate emission feature which has an onset between 7 and 8 microns. There is no evidence for the 7.5 microns feature observed by the Vega 1 spacecraft; the large difference between the areal coverage viewed from the spacecraft and the airplane may explain the discrepancy. Color temperatures significantly higher than a blackbody indicate that small particles are abundant in the coma. Significant spatial and temporal variations in the spectrum show trends similar to those observed from the ground. ESA

N87-25929*# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.
MULTIPLE APERTURE AIRBORNE INFRARED MEASUREMENTS OF COMET HALLEY
R. W. Russell, D. K. Lynch, R. J. Rudy, G. S. Rossano, J. A. Hackwell, and H. C. Campins (Planetary Science Inst., Tucson, Ariz.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 125-128 (For primary document see N87-25908

19-90)
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Observations at 10 microns with a 3.5' diameter beam made from the NASA Lear Jet Observatory during April 7.6 to 11.6, 1986 UT are presented. Data show evidence for a dramatic outburst (factor of 3 in 10 micron flux) with a turn-on time of 1 day and turn-off time of 1 to 2 days. Total mass ejected in the outburst is estimated. When combined with 8 an.J 10 microns data taken by Campins et al the dependence of the dust density on distance from the nucleus can be evaluated. It is shown that the flux within an aperture of diameter D is directly proportional to D well beyond 60' (2 million m at the comet). At 64 million m diameter (210'), the measurements are only 30% below the level expected for a strict F varies as d dependence. This, combined with the time scales of the event, places constraints on processes of grain destruction. The energy of the outburst is derived and compared to solar heating. ESA

N87-25930*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DUST ENVIRONMENT OF COMET HALLEY
Z. Sekanina *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 131-143 (For primary document see N87-25908 19-90)
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Advances in the understanding of comet Halley's dust environment are highlighted. Spacecraft results on the dust composition, the detection of subfemtogram grains, and the particle-mass distribution; jets and the dust-emission pattern; the existence of discrete sources on the nucleus surface and the determination of their locations from day-to-day motions of coma features; CN jets; large-scale phenomena, including an antitail, streamers, and a sunward spike; infrared observations, such as the 3.4 microns emission feature, applications of array detectors, and rare far-infrared data; the chemical modification of low-temperature ices by UV and cosmic-ray irradiation processes, their laboratory simulations, and applications to the evolution of comets; the interstellar-connection models of comet origin; and the formation of a mantle made of refractory organic material on the nucleus surface. ESA

N87-25931*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COMET HALLEY NEAR-NUCLEUS PHENOMENA IN 1986
S. Larson, Z. Sekanina, D. Levy, S. Tapia, and M. Senay (Orange Free State Univ., Bloemfontein, South Africa) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 145-150 (For primary document see N87-25908 19-90)
(Grant NAGw-247)
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Computer enhanced high resolution groundbased images taken during Halley's most active phases in 1985-86 exhibit all of the coma structures identified in 1910 photographs. The structures result mostly from discrete dust jet activity producing spirals, arcs, and jagged-edged envelopes. Multiple nucleus and antisunward jet phenomena are also observed. The curvature of the jets is consistent with the location of the Earth with respect to the nucleus equatorial plane. The variation in jet activity during the Vega and Giotto flybys is easily seen on the groundbased images. Images of CN jets show that they usually do not correlate with dust jets. Wide field, medium resolution images of faint outer envelopes are required to augment the smaller field, high resolution images of near-nucleus jets in modeling the jets. ESA

N87-25932# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
CCD-OBSERVATIONS OF COMET HALLEY FROM SOUTH AFRICA WITH THE GIOTTO HMC AND THE IHW FILTERS
C. B. Cosmovici, P. Mack, H. Craubner (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen, West Germany), and G. Schwarz *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 151-155 Original contains color illustrations (For primary document see N87-25908 19-90)
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In the period March 13-18, 1986 the CCD-System of the 192 cm telescope at Sutherland (RSA) was used to obtain 137 images with the Giotto-HMC and IHW-filters for near nucleus studies. The spatial resolution varied between 350 and 1000 km in a region of 144,000 x 205,000 km thus permitting excellent imaging before, during, and after the Giotto flyby. The CCD-observations permit absolute photometry of the coma with 23 different filters and morphological studies as detection of jets, information about the nucleus rotation, and the extension of dust and gas (neutrals and ions) around the nucleus. ESA

N87-25933# Kent Univ., Canterbury (England).
NEAR NUCLEUS CCD IMAGING OF COMET HALLEY AT THE TIME OF THE SPACECRAFT ENCOUNTERS
S. F. Green and D. W. Hughes (Sheffield Univ., England) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 157-161 Sponsored by the UK Science and Engineering Research Council (For primary document see N87-25908 19-90)
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Almost 200 CCD images were taken between March 3-24 1986 using the 3.9m Anglo-Australian Telescope and filters identical to those incorporated in the Halley multicolor camera. The filter set contained narrow-band filters to isolate C2 (570nm), C3 (410nm) and OH (320nm) emissions and the dust continuum at 450nm and 730nm, as well as several wide band filters. Each 512x320 pixel image covered an area 180,000 x 110,000km with seeing limited resolution of 400 to 800km. The inner coma structure changed dramatically from night to night and the dust images exhibit a number of jets. A series of these taken 5 hr before Giotto encounter were used to estimate the dust density along the trajectory for comparison with data from the dust impact detection system. ESA

N87-25934# Kent Univ., Canterbury (England). Unit for Space Sciences.
COMPUTER MODELLING OF DUST FROM COMET P/HALLEY AND COMPARISON WITH GROUND-BASED OBSERVATIONS AND IN-SITU MEASUREMENTS
S. C. Chakaveh, S. F. Green, J. K. Ridley, J. A. M. McDonnell (Sheffield Univ., England), and D. W. Hughes *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 163-165 Sponsored by the UK Science and Engineering Research Council (For primary document see N87-25908 19-90)
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A computer model is used to generate a map of the brightness distribution expected for Earth based measurements of comet P/Halley at the time of Giotto encounter. This map is compared with high resolution CCD images taken around the same time using the 3.9 m Anglo-Australian Telescope. Dust jets were detected and enhanced from these images, for comparison with results from Giotto. ESA

N87-25935# Michigan Univ., Ann Arbor. Space Physics Research Lab.
A HEURISTIC MODEL OF THE COMET HALLEY DUST SIZE DISTRIBUTION

Tamas I. Gombosi *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 167-171 (For primary document see N87-25908 19-90)
(Grant NSF AST-86-05994)
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A differential dust production rate distribution at the surface of comet Halley is proposed. The integral of this function over all dust sizes yields a divergent result, consequently the cutoff size (the size of the largest particles capable of leaving the surface of the nucleus) determines the normalization factor of the entire distribution function to a very large extent. A factor of 10 change in the cutoff size can result in a variation of several orders of magnitude of the number of submicron size dust particles. It is suggested that a localized disruption (crack) developed in the evacuated surface dust mantle shortly before the arrival of Vega 1. Dust particles freshly released from this newly uncovered ice are thought to have a higher friability parameter value than from a well developed mantle, consequently one expects a decrease of the cutoff size during a mantle disruption event. By the time of the Giotto encounter a new mantle had evolved thus decreasing the friability. This decreasing friability resulted in a higher cutoff size and in a dramatic decrease of the number of submicron size particles. ESA

N87-25936# Liege Univ. (Belgium). Inst. d'Astrophysique.
EARLY RESOLVED STRUCTURES IN THE COMA OF COMET HALLEY
F. Dossin, P. Guerin, S. Koutchmy, P. Lamy, and P. Malburet (Laboratoire d'Astronomie Spatiale, Marseille, France) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 173-176 (For primary document see N87-25908 19-90)
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Three high-resolution photographs of comet Halley were obtained on Sept. 12, 1985 with the Schmidt telescope at the Observatoire de Haute-Provence (France) on hypered Kodak 2415 film and exposure times of 1 hr. The best image (FWHM of 2 arcsec) was analyzed to deduce the 2-dimensional distribution of light presumably scattered by the dust. Two jet-like structures are present in the near nuclear region, one extending outward up to 15 arcsec. The total absolute magnitude was determined. ESA

N87-25937*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SUNWARD SPIKE AND EQUATORIAL PLANE OF HALLEY'S COMET
Z. Sekanina, S. M. Larson, G. Emerson, E. F. Helin (Naval Observatory, Washington, D.C.), and R. E. Schmidt *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 177-181 Sponsored by the Planetary Society and the World Space Foundation (For primary document see N87-25908 19-90)
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Photographs from late April until at least early June 1986 of comet Halley show a narrow spike in the Sun's direction. It extends to distances of at least 700,000 km from the nucleus in projection onto the sky on computer processed photographs. The spike is composed of dust and its enormous sunward extent (compared to other dust features) suggests an anomalously high ratio of particle ejection velocity to solar radiation pressure. The implied grains are either dielectric or slightly absorbing and much less than 1 micron in size, which are undetectable optically, unless Earth is located in or very near a plane of their concentration. The only plane to which these grains can possibly be confined for long is the equatorial plane of the nucleus, especially when the obliquity is small. Accordingly, the spike's position as a function of time contains information on the comet's spin axis. ESA

N87-25938*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Unit for Space Sciences.
MASS DISTRIBUTION OF PARTICULATES MEASURED BY GIOTTO'S DUST IMPACT DETECTION SYSTEM (DIDSY) IN THE CLOSE ENCOUNTER PERIOD
J. C. Zarnecki, J. A. M. McDonnell, W. M. Burton, W. M. Alexander (Baylor Univ., Waco, Tex.), and M. S. Hanner *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 185-190 Sponsored by the UK Science and Engineering Research Council, BMFT, CNES and CNR (For primary document see N87-25908 19-90)
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The cumulative mass distribution of the comet Halley dust efflux in the close encounter period -300 to +300 sec was analyzed. Analysis of the cumulative mass distribution index (alpha) shows considerable short time scale variation. There is clear evidence from the flux rates of passage through at least one major dust enhancement (dust jet) just after closest approach and this is associated with a steepening of the alpha. Comparison with measurements from other sources, and with preencounter predictions, is also made. ESA

N87-25939# Max-Planck-Inst. fuer Kernphysik, Heidelberg (West Germany).
PERFORMANCE OF THE IMPACT PLASMA AND MOMENTUM DETECTOR (DIDSY-IPM) BEFORE CLOSEST APPROACH TO COMET HALLEY **c19**
G. Lange, E. Gruen, D. Maas, J. R. Goeller, J. Kissel, E. Bussoletti, J. A. M. McDonnell, J. C. Zarnecki (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands), and R. J. L. Grard *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 191-193 (For primary document see N87-25908 19-90)
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The Giotto impact plasma and momentum sensor (DIDSY-IPM) was designed to measure the dust flux, mass distribution, and the density of cometary particles in Halley's coma. It was protected by a plastic foil cover, to be retracted before the Halley encounter. The IPM data from Halley encounter in comparison with dust fluxes, derived from the PIA experiment and in combination with the results from laboratory experiments, suggest that the protective cover of the IPM-sensor was not released properly before closest approach. This implies that only the dust flux of particles with masses larger than the penetration limits for 2 or 3 of the cover foils (m greater than or = 3 times 10 to the minums 10th power and minus 9th power g, respectively) can be determined. There is evidence that the IPM protective cover was released shortly before closest approach. ESA

N87-25940# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
AN ATTEMPT TO EVALUATE THE STRUCTURE OF COMETARY DUST PARTICLES
V. Smirnov, O. Vaisberg, and S. Anisimov (Institute for Theoretical and Experimental Physics, Moscow, USSR) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 195-199 (For primary document see N87-25908 19-90)
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Comparison of counting rates of two sensors of the Vega SP-1 plasma impact detector: an open one and one shielded by thin foil, as well as their counting rate profiles gives information on particle density and on processes occurring during penetration of the film by particles. Density of 1 cc does not contradict measurements. Existence of less dense particles is suggested. ESA

N87-25941# Kent Univ., Canterbury (England). Unit for Space Sciences.
DUST EMISSION STUDIES IN HALLEY'S INNER COMA: AN APPROACH TO MODELLING THE NUCLEUS EMISSION CHARACTERISTICS
G. S. Pankiewicz and J. A. M. McDonnell *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 201-206 Sponsored by the UK Science and Engineering Research Council (For primary document see N87-25908 19-90)
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Using a model for the dynamics of particulates emitted from Halley at distances much smaller than the apex of the dust envelope, fluxes measured by Giotto plasma and momentum sensor and Vega 2 are traced back to Halleycentric nucleus coordinates to yield a unified comparison of the two data sources. Mass distribution indices are interrelated, and properties of the angular source distribution of Halley relative to the subsolar emission point are examined. Variability of the nucleus emission rate is discussed. ESA

N87-25942# Remeis Sternwarte, Bamberg (West Germany).
THE CHARGE OF FLUFFY DUST GRAINS OF SILICATE AND CARBON NEAR P/HALLEY AND P/GIACOBINI-ZINNER
H. Boehnhardt *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 207-213 (For primary document see N87-25908 19-90)
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The equilibrium potential of spherical dust grains of silicate and carbon in the coma of P/Halley and P/Giacobini-Zinner is modeled numerically using the in-situ measurements of the plasma experiments flown aboard the Giotto and ICE spacecraft. For both comets silicates are found to carry positive potentials (+7 to +10 V); carbonic grains are positively charged near P/Halley (+6 to +3 V), but show repeated changes of their signs in the plasma environment of P/Giacobini-Zinner (+6 to -18 V). The times for charging range up to several thousand seconds. Only very weak grains (delta T = 1000 to 10,000 dyn */sqcm) with less than 1 micron radii can fragmentate in the comae of the comets. ESA

N87-25943*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DUST DISTRIBUTION OF COMET HALLEY FROM THE GIOTTO RADIO SCIENCE EXPERIMENT
P. Edenhofer, H. Buschert, H. Porsche, M. K. Bird, H. Volland (Bonn Univ., West Germany), J. P. Brenkle, E. R. Kursinsky, N. A. Mottinger, and C. T. Stelzried *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 215-218 (For primary document see N87-25908 19-90)
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Measurements from the Giotto radio science experiment representing the Doppler frequency shift and the intensity level of the X-band downlink signal of the Giotto spacecraft during its encounter with comet Halley are shown. Continuous data reception was maintained throughout the encounter. The Doppler shift measured within a time interval of 100 sec is due to drag effects in the cometary atmosphere causing a deceleration of the spacecraft. The total change of velocity of Giotto is 23.2 cm/sec resulting in a best estimate of 0.32 g for the total cometary mass impacting Giotto during the Halley flyby. A dust jet structure for the inner coma of comet Halley is derived. Several sharply confined dust jets are distinguishable; for the most prominent one, characteristic properties are deduced. Features of this jet structure are shown to correlate with measurements from on-board Giotto experiments and with Earth-based observations. ESA

N87-25944# Tokyo Univ. (Japan). Inst. of Space and Astronautical Science.
COLLISION OF LARGE DUST PARTICLES WITH SUISEI SPACECRAFT
K. Uesugi *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 219-222 (For primary document see N87-25908 19-90)
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During the time of closest approach to P/Halley, Suisei was hit twice by dust particles believed to come from the comet nucleus. The first collision occurred at 12:54 UT at a distance of 160,000km from the nucleus and the second at 175,000km (13:26 UT). Although Suisei has no dust counter or detector, the mass of these particles can be estimated by the analysis of attitude change of the spin-stabilized spacecraft perturbed by the collisions. The result shows that the minimum weight of the first particle is several milligrams and second one was several tens of micrograms. ESA

N87-25945# Slovak Academy of Sciences, Bratislava (Czechoslovakia). Inst. of Astronomy.
ON METEOR CONTRIBUTION BY SHORT-PERIOD COMETS
J. Stohl *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 225-228 (For primary document see N87-25908 19-90)
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Contribution of P/Halley and other comets to meteor streams is discussed. Meteor production by comet P/Encke as the potential major contributor to the meteoric complex in the inner part of the solar system, taking into account the whole complex of its showers and of the very broad and diffuse stream of seemingly sporadic meteoroids, associated with P/Encke and apparently produced by it via its showers is considered. Results suggest a few very productive periods of meteoric material, connected with catastrophes. ESA

N87-25946# Lund Observatory (Sweden).
THE 1985 RETURN OF THE GIACOBINID METEOR STREAM
B. A. Lindblad *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 229-231 (For primary document see N87-25908 19-90)
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Radar observations of the 1985 return of the Giacobinid meteor shower are described. The shower was of 3 hrs duration, rising steeply to a maximum at 09.35 UT on Oct. 8 1985. The meteor shower shows the same short period characteristics as the intense showers of 1933 and 1946. Peak meteor echo rates of 75 occurred in the 10 min interval 09.30 to 09.40 UT. The corresponding shower zenithal rate at maximum after removal of background activity is 484 echoes/hr. The longitude of the descending node of the shower at maximum is 194 deg 55 (equinox 1950). The plane of the central part of the 1985 shower is displaced by 0 deg 15 in longitude with respect to the orbital plane of the comet. ESA

N87-25947# University of Western Ontario, London.
ON THE STRUCTURE OF THE HALLEY COMET METEOR STREAM
J. Jones and B. A. McIntosh (National Research Council of Canada, Ottawa, Ontario) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 233-237 Sponsored by the Canadian Natural Sciences and Engineering Research Council (For primary document see N87-25908 19-90)
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To study the Orionid and Eta-Aquarid meteor stream development, the motion of 500 test particles released from the

comet with ejection velocities calculated according to Whipple was integrated over long periods assuming Jupiter to be the only gravitational perturbation. It is found that the stream cross-section in the ecliptic plane becomes highly elliptical within a few thousand years. This confirms the ribbon-like stream structure proposed by McIntosh and Hajduk (1983) which explains most of the observed features of the showers. Fine structure features develop rapidly and are most apparent for more massive particles. The minimum age of the Orionid shower is 3000 yr. ESA

N87-25948# Slovak Academy of Sciences, Bratislava (Czechoslovakia). Inst. of Astronomy.
METEOROIDS FROM COMET HALLEY AND THE COMETS MASS PRODUCTION AND AGE
A. Hajduk *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 239-243 (For primary document see N87-25908 19-90)
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The flux of meteoroid size particles ejected from comet Halley in the mass range from 10 to the minus 9 to 10 to the minus 1 kg and observed by radar and optical methods is compared with the flux of dust particles in the mass range from 10 to the minus 20th to minus 8th power kg measured by space probes. The theory of the orbital motion of the comet and of the shell model of the stream corresponds within the observational errors of particle fluxes to the initial mass of the comet = 3.2 times 10 to the 15th power kg, and an effective diameter of 21 km, with the age of 23,000 revolutions. ESA

N87-25949# Herzberg Inst. of Astrophysics, Ottawa (Ontario).
THE SPECTRA OF METEORS FROM HALLEY'S COMET
Ian Halliday *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 245-248 (For primary document see N87-25908 19-90)
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The spectra of 17 bright Orionid meteors from comet Halley, photographed between 1958 and 1968, are compared with the spectra of other fast meteors. The spectral region from 3100 to 8700 A is covered, with a wide range of instrumental dispersion. The brightest members of the group have peak absolute magnitudes between -7 and -9, indicating masses of a few tens of grams. There is thus clear evidence that large particles from comet Halley survive to encounter the Earth. Although the Orionid spectra are not as detailed as the best spectra of Perseid meteors (from P/Swift-Tuttle, 1862 III) lines of 6 neutral atomic species and 5 singly-ionized species are observed. Differences in abundances of these elements between the two showers (and parent comets) are marginal. ESA

N87-25950# University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.
EVAPORATING GRAINS IN HALLEY'S COMA
M. K. Wallis, R. Rabilizirov, and N. C. Wickramasinghe *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 251-254 (For primary document see N87-25908 19-90)
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It is suggested that the organic grains streaming from Halley's nucleus lose substantial volatile constitutents within 100,000 sec. Evidence includes the increasing fraction of organic to mineral grains nearer the nucleus. The high C and CH content in the gas and plasma phases, reduced CO within 15,000 km, the different behavior of OH and H strengths with heliocentric distance, the large surface area needed to explain radiation-driven sublimation, and the appearance of the 10 micron IR feature only within 1.3 AU. While submicron grains of ice contaminated by 1% or more absorptive graphite can explain the strong OH coma far from the Sun, as in comet Bowell at 4.6 AU, the dynamical lifetime of the grain coma implies mm-sized and therefore cooler grains, with lower H2O or OH attachment energies near 10 kcal/mole. Grains in comet Halley, if composed of similar organic material must also contain fractions of more strongly bound components. Kerogen is adopted as a prototype organic complex having a range of bond energies. ESA

N87-25951# Leiden Univ. (Netherlands). Astrophysics Lab.
THE ORIGIN AND EVOLUTION OF COMET NUCLEI AND COMET HALLEY RESULTS
J. Mayo Greenberg and Ruud Grim *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 255-263 (For primary document see N87-25908 19-90)
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The chemistry and morphological structure of a comet nucleus as an aggregate of interstellar dust is used to provide comparisons with comet Halley results: the density of the nucleus and of the dust; the dust cloud model and its consequences on the production of C(+) and CN in the coma by small organic grains; the surface albedo and the nucleus heat conductivity and high surface temperature; the appearance of 10 to the minus 14th to minus 17th power g dust particles along with higher masses; the mass spectra of dust and infrared spectroscopy as evidence for complex organic grain mantles (0.15 microns) and of very small (0.01 micron) carbonaceous and silicate grains; and the appearance of small grains resulting from breakup of larger grains. The cosmic ray dosage of a comet nucleus during its 4 1/2 billion yr in the Oort cloud appears to be many orders of magnitude less than the dosage of the pre-aggregated interstellar dust by ultraviolet photons except perhaps in the outer few meters of the nucleus of a new comet. It is shown that solar heating of the interior of a nucleus is lower than previously estimated. ESA

N87-25952# Academy of Sciences, Berlin (East Germany). Inst. fuer Kosmosforschung.
AN APPROACH TO THE NATURE OF THE SILICATIC COMPONENT OF COMET HALLEY
R. Waesch *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 265-267 (For primary document see N87-25908 19-90)
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Silicate spectra of mode 0 from the mass spectrometer on Vega-1 are analyzed. The ratios of the elements Mg, Fe, Ca, Al, Na, K, S, and O to Si show a trend which is known from C I-carbonaceous chondrites and Brownlee particles. In connection with hypothetical silicates a possible model assembly of cometary dust silicates is proposed. ESA

N87-25953# Virginia Univ., Charlottesville. Inst. of Nuclear Engineering and Engineering Physics.
RADIATION FORMATION OF A NONVOLATILE CRUST
R. E. Johnson, J. F. Cooper, and L. J. Lanzerotti (Bell Telephone Labs., Inc., Murray Hill, N. J.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 269-272 Sponsored by NSF (For primary document see N87-25908 19-90)
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Radiation effects on cometary materials, and mantle formation are discussed. Ion irradiation of the outer meters of a cometary surface produces new molecular species in the solid state. Because of the vacuum interfaces these segregate in an irreversible way into a nonvolatile residue and new very volatile species, which are lost directly or lost when the comet enters the inner solar system. It is, therefore, likely that a comet exposed to background radiations in the Oort cloud obtains an outer web of nonvolatile material which leads to the formation of a substantial crust (100 gm/sqcm). Except for fizzures and break-off of pieces due to warming of subsurface gases, this mantle should be continuously

hardened for a periodic comet due, primarily, to thermal processing. There are also active regions which were shaded from cosmic ray radiation. ESA

N87-25954# Chicago Univ., Ill. Dept. of Chemistry.
THE DARK NUCLEUS OF COMET HALLEY: HYDROGEN CYANIDE POLYMERS
C. N. Matthews and R. Ludicky *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 273-276 (For primary document see N87-25908 19-90)
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It is proposed that the dark crust of comet Halley consists largely of hydrogen cyanide polymers. The expected predominance on cometary nuclei of frozen volatiles such as methane, ammonia, and water makes them ideal sites for the formation and condensed-phase polymerization of HCN. Dust emanating from Halley's nucleus, contributing to the coma and tail, would also arise partly from the polymer. Secondary species such as CN are widely detected, as well as HCN itself. The significance of these results is considered in relation to the origin of life on Earth and to extraterrestrial chemistry. ESA

N87-25955*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE COMETARY NUCLEUS: CURRENT CONCEPTS
Fred L. Whipple *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 281-288 Sponsored by NASA (For primary document see N87-25908 19-90)
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Ideas concerning the nature of cometary nuclei as modified by observations of recent years, particularly by those of Halley's comet during the 1986 apparition are reviewed. The major trend is to increase the postulated dimensions of the nuclei and reduce their albedos. The Vega and Giotto missions establish an invaluable checkpoint with regard to comet nuclei. These and other observations are affecting opinions concerning many facets of cometary nature, origin, evolution, and decay. ESA

N87-25956# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
TV EXPERIMENT IN VEGA MISSION: STRATEGY, HARDWARE, SOFTWARE c12
R. Z. Sagdeev, G. A. Avanesov, I. V. Barinov, V. I. Kostenko, V. A. Krasikov, V. A. Shamis, K. G. Sukhanov, V. I. Tarnopolsky, Yu. K. Zaiko, S. I. Zatsepin et al. *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 289-294 (For primary document see N87-25908 19-90)
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The strategy of the Vega TV experiment was based on a high priority for the nucleus shape and volume determination. Hence, a relatively safe trajectory was chosen for the spacecraft to observe the nucleus from different viewing angles. The study of the dynamics of the cometary inner regions, first of all the estimation of the nucleus rotation parameters, relies on comparative analysis of images obtained by the two spacecraft in approximately identical conditions but on different dates. The television system was designed as a 2 camera (focal lengths 1200 and 150 mm), 4 channel system with CCD imagers. It permits imaging with angular resolutions of 35 and 28 arcsec in 6 different spectral bands in the range 400 to 1100 nm. The image formats sent to the Earth are 128x128 and 512x512 pixels. ESA

N87-25957# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
TV EXPERIMENT IN VEGA MISSION: IMAGE PROCESSING TECHNIQUE AND SOME RESULTS c32
R. Z. Sagdeev, Ya. L. Ziman, A. A. Kuzmin, G. A. Avanesov, V. A. Krasikov, V. A. Shamis, V. A. Tarnopolsky, K. Szego, E. Merenyi, and B. A. Smith: (Central Research Inst. for Physics, Budapest, Hungary) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 295-305 Original contains color illustrations (For primary document see N87-25908 19-90)
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About 50 pictures of comet Halley, taken by Vega-1 and Vega-2 spacecraft during the approach from 500 to 8000 km were subjected to multistage processing. The processing stages involved image restoration and noise reduction, nucleus region detection, nucleus shape and size evaluation, jet extraction, and surface structure enhancement. The results of the successive procedures for image restoration and noise removal (in the brightness and spatial-frequency domain) are given. Different approaches and the algorithms concerned for nucleus region detection, and identification of the limbs not obscured by the jets are described. Taking into consideration a set of located limb edges, the nucleus shape and size are evaluated. The texture enhancement of the nucleus surface is discussed. ESA

N87-25958# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
TV EXPERIMENT IN VEGA MISSION: NUCLEUS SHAPE RECONSTRUCTION AND COMA TOMOGRAPHY. METHODS AND PRELIMINARY RESULTS c32
R. Z. Sagdeev, Ya. L. Ziman, G. A. Avanesov, V. I. Tarnopolsky, V. A. Krasikov, D. A. Usikov, A. S. Debabov, K. G. Sukhanov, A. Yu. Kogan, V. N. Kheifets et al. *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 307-316 Original contains color illustrations (For primary document see N87-25908 19-90)
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About 60 images taken by Vega spacecraft during the close approach to Halley were utilized for nucleus shape reconstruction. A gradient algorithm was applied to the images and nucleus limbs were extracted. A three dimensional model of the nucleus was defined as an intersection of the cylinders provided by parallel shift of the scaled limbs along the corresponding lines of view. Tomography restoration for scattering efficiency distribution in the inner coma was based on the modified Cormack's method using the same 60 images. ESA

N87-25959# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
TV EXPERIMENT OF THE VEGA MISSION: PHOTOMETRY OF THE NUCLEUS AND THE INNER COMA c32
R. Z. Sagdeev, G. A. Avanesov, Ya. L. Ziman, V. I. Moroz, V. I. Tarnopolsky, B. S. Zhukov, V. A. Shamis, B. Smith, and I. Toth (Central Research Inst. for Physics, Budapest, Hungary) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 317-326 (For primary document see N87-25908 19-90)
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Vega photometry of comet Halley's nucleus reveals albedo = 0.04 wavelength independent in the range 0.5 to 0.9 microns. Dust production on the surface has strong horizontal inhomogeneities, with jets of different intensities and relatively transparent fields. Vertical optical thickness of dust is less than 0.1 outside the strongest jets. Part of the visible surface radiance inhomogeneities can be connected with the real surface structure (morphology and albedo differences). The angle dependence of radiance is like that for the Moon surface. Dust coma between 100 and 1000 km looks like a broad sunward oriented cone. There are differences in the structure of the features between images obtained by 2 probes with the time interval (72 hr). ESA

N87-25960# Central Research Inst. for Physics, Budapest (Hungary).
THE SPATIAL DISTRIBUTION OF DUST JETS SEEN AT VEGA-2 FLY-BY
B. Smith, K. Szego, S. Larson, E. Merenyi, I. Toth, R. Z. Sagdeev, G. A. Avanesov, V. A. Krasikov, V. A. Shamis, and V. I. Tarnapolski (Academy of Sciences, USSR, Moscow) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 327-332 (For primary document see N87-25908 19-90)
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Eleven full-format (512x512 px) Vega-2 images taken over a 15 min. interval starting 370 sec. before closest approach were used to analyze dust jets. The distance to the nucleus was always less than 45,000 km and become as close as 8030 km. Measurements of the position of the same feature seen on different images, together with knowledge of the changing spatial relationship between Vega and comet yield the absolute spatial orientation of the feature. Most of the active zones formed at least one quasi-linear structure on the surface. Evidence of the activity of the dark hemisphere was found; at least one of the faint but active jet sources is there. Results are compared to ground observations. ESA

N87-25961# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
ROTATION PERIOD AND SPIN AXIS OF COMET HALLEY
R. Z. Sagdeev, V. A. Krasikov, V. A. Shamis, V. I. Tarnopolski, K. Szego, I. Toth, B. Smith, S. Larson, and E. Merenyi (Arizona Univ., Tucson.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 335-338 (For primary document see N87-25908 19-90)
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The rotation period and orientation of the spin axis, of comet Halley were derived using Vega 1 and Vega 2 images. The results, which improve earlier published values, are a rotation period of 53.5h + or - 1.0hr, with the spin vector directed toward l=22deg and b=-63deg ecliptic coordinates. These agree with the observation of Giotto multicolor camera. ESA

N87-25962# Academy of Sciences, Berlin (East Germany). Inst. fuer Kosmosforschung.
PHYSICAL PROPERTIES OF P/HALLEY DERIVED FROM VEGA IMAGES
D. Moehlmann, T. Mangoldt, H. Boerner, B. Rubbert, M. Danz, U. Weidlich, and G. Elter *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 339-340 (For primary document see N87-25908 19-90)
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The surface structure of P/Halley was analyzed using Vega images. Using a three-axial ellipsoid to approximate P/Halley, the derived dimensions are 16km x 8km x 6km. Along the longest axis the perpendicular dimensions decrease from 8km x 6km to 5km x 4km. The uncertainties in every dimension are 1km. Brightness distribution is shown. ESA

N87-25963# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Service d'Aeronomie.
SOME PHYSICAL CHARACTERISTICS OF HALLEY'S NUCLEUS AS INFERRED FROM VEGA AND GIOTTO PICTURES
J. L. Bertaux and A. Abergel *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 341-345 (For primary document see N87-25908 19-90)
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From the contours of the nucleus of Halley's comet as observed with Vega-1, Vega-2, and Giotto pictures, the overall shape of the nucleus, volume, and surface area are determined, using a CAD program. A rotation period of 53 hr is shown to be more consistent with the pictures than a 7.5 day period, which could be a nutation period. Only prograde motions are possible for these two periods. The volume is 375 cukm + or - 30% and the surface area 305 kmsq + or - 20%. Compared with the mass estimate of 50 to 160 gigatons the density of the nucleus is small, between 0.1 and 0.54 tons/cum. It implies a formation distance much larger than Uranus-Neptune region. It is speculated that the porosity of the nucleus allows compressibility and flexibility of the nucleus. ESA

N87-25964# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
OBSERVATIONS BY THE HALLEY MULTICOLOR CAMERA **c35**
H. U. Keller, C. Arpigny, C. Barbieri, R. M. Bonnet, S. Cazes, M. Coradini, C. B. Cosmovici, W. Curdt, W. A. Delamere, W. F. Huebner (Los Alamos Scientific Lab., N. Mex.) et al. *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 347-350 Sponsored by NASA, BMFT, Max-Planck-Gesellschaft, DFVLR, CNES, SPPS and CNR (For primary document see N87-25908 19-90)
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The first image of comet Halley was taken by the multicolor camera (HMC) on 9 March from a distance of 23.6 million km. During the encounter HMC was switched on at 4:12 hr before closest approach CA. It took its first image at 3:06 h before CA. Overall 2043 images were taken in single sensor mode. The inner coma was observed using all 11 filters and polarizers. The transmission curves of the filters (except polarizers) are shown together with the sensitivity of the camera. At 6 min before CA HMC switched to multiple sensor mode taking 4 images almost simultaneously through the clear, blue, and red wideband filters. Only 2% of all data taken could be transmitted in 69 image sets. The last image showing details of the nuclear surface was taken from a slant distance of 1740 km and has a nominal resolution of 39 m per pixel. ESA

N87-25965*# Ball Aerospace Systems Div., Boulder, Colo.
NUCLEUS MORPHOLOGY OF COMET HALLEY
H. J. Reitsema, W. A. Delamere, W. F. Huebner, H. U. Keller, W. K. H. Schmidt, K. Wilhelm, H. U. Schmidt, and Fred L. Whipple (Smithsonian Astrophysical Observatory, Cambridge, Mass.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 351-354 (For primary document see N87-25908 19-90)
(Contract NASw-3573)
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CSCL 03B

Images obtained by the Halley multicolor camera were used to determine the projected size and shape of the nucleus. The location of the terminator and numerous surface features were determined. There is good correlation between the brightest surface features and the dust jets; however, many bright features are seen which are not associated with jets. Most of the observed features are circular and appear to be related to surface elevation. The angularity of the terminator gives an indication of the three-dimensional structure of the face which was observed. ESA

N87-25966*# Ball Aerospace Systems Div., Boulder, Colo.
RADIOMETRIC OBSERVATIONS OF THE NUCLEUS OF COMET HALLEY
W. A. Delamere, H. J. Reitsema, W. F. Huebner, H. U. Schmidt, H. U. Keller, W. K. H. Schmidt, K. Wilhelm, and Fred L. Whipple (Smithsonian Astrophysical Observatory, Cambridge, Mass.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 355-357 (For primary document see N87-25908 19-90)
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Images obtained by the Halley multicolor camera (HMC) were used to determine the surface brightness of the nucleus. Radiometric values of jet-free areas of the surface are presented and a range of possible surface brightness values are derived. These direct measures are compared with brightnesses derived from the size of the nucleus, as determined from HMC images, and ground-based observations obtained before the onset of coma activity. ESA

N87-25967# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).

DUST ACTIVITY OF COMET HALLEY'S NUCLEUS

H. U. Keller, W. A. Delamere, W. F. Huebner, H. Reitsema, H. U. Schmidt, W. K. H. Schmidt, Fred L. Whipple (Smithsonian Astrophysical Observatory, Cambridge, Mass.), and K. Wilhelm *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 359-362 Sponsored by NASA, BMFT, Max-Planck-Gesellschaft, DFVLR, CNES, SPPS and CNR Original contains color illustrations (For primary document see N87-25908 19-90)

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Images obtained by the Halley multicolor camera using the clear filter with a pass band from 300 to 1000 nm were used to study dust activity in the comet nucleus. Comparisons with ground based observations confirm that dust production towards the Sun increases in activity relative to the southern background source while the Giotto spacecraft was approaching. This is in agreement with the assumption that the sunward activity becomes stronger when the source rotates towards the Sun. Estimated dust column density is 90 billion/sqm, with optical thickness less than or = 0.3. Surface reflectivity is less than 1%, indicating a very rough surface with large fractions of shadowed areas. ESA

N87-25968*# Los Alamos Scientific Lab., N. Mex.

DUST-GAS INTERACTION DEDUCED FROM HALLEY MULTICOLOR CAMERA OBSERVATIONS

W. F. Huebner, H. U. Keller, K. Wilhelm, Fred L. Whipple, W. A. Delamere, H. J. Reitsema, and H. U. Schmidt (Max-Planck-Inst. fuer Physik und Astrophysik, Garching, West Germany) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's comet. Volume 2: Dust and Nucleus Dec. 1986 p 363-364 Previously announced as N87-21782 Sponsored by NASA (For primary document see N87-25908 19-90)

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The dust and gas productions of comet Halley were measured by the dust counter and the mass spectrometers on the Giotto spacecraft. These instruments give only little information about the spatial asymmetry of the activity. The asymmetry in the dust production is clearly evident from the dust jets seen in the Halley Multicolor Camera images. Since the dust is entrained by the gas, gas production must be similarly asymmetric. The intensity profiles along and across several dust jets are related to their source regions on the nucleus. Properties of the dust jets are investigated. A few compact, but highly active source regions on the nucleus produce most of the visible dust and can account for most of the gas produced by the comet. ESA

N87-25969# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).

A THREE-DIMENSIONAL MODEL OF THE NUCLEUS OF COMET HALLEY

K. Wilhelm, C. B. Cosmovici, W. A. Delamere, W. F. Huebner, H. U. Keller, H. Reitsema, H. U. Schmidt, and Fred L. Whipple (Harvard Coll. Observatory, Cambridge, Mass.) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 367-369 Sponsored by NASA, BMFT, Max-Planck-Gesellschaft, DFVLR, CNES, SPPS and CNR (For primary document see N87-25908 19-90)

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The nucleus of comet Halley was observed by the Halley Multicolor Camera (HMC) during the last minutes of the flyby sequence before reaching the point of closest approach. The phase angle change during the observational period was less than 17 deg, so HMC data can only define a two-dimensional contour of the nucleus at a certain time. The overall geometry during the HMC observations is outlined and the findings are related to information available from other sources at different times. The nucleus of the comet is described as a triaxial ellipsoid with major axes of 16, 10, and 9 km. The rotation axis is directed towards delta 1950 = -(40 + or - 5) deg and alpha 1950 = (50 + or - 10) deg. The rotation with a period of P = (54 + or - 1) is in a prograde sense with respect to the orbital motion. ESA

N87-25970# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Hauptabteilung Angewandte Datentechnik.

DETAILED ANALYSIS OF A SURFACE FEATURE ON COMET HALLEY **c89**

G. Schwarz, H. Craubner, A. Delamere, M. Goebel, M. Gonano, W. F. Huebner, H. U. Keller, R. Kramm, E. Mikusch, H. Reitsema (Ball Aerospace Systems Div., Boulder, Colo.) et al. *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 371-374 (For primary document see N87-25908 19-90)

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Using a photoclinometric method the topography of a craterlike surface future on Halley's comet is analyzed, using multicolor images. The rim to rim distance is 1600 m, with a dip depth (below a rim to rim line) of less than 100 m. Inspection of the rim reveals a rugged contour with uneven structures. ESA

N87-25971# Consiglio Nazionale delle Ricerche, Frascati (Italy). Inst. di Fisica dello Spazio Interplanetario.

GROUNDBASED CCD-OBSERVATIONS OF COMET HALLEY WITH THE GIOTTO-HMC-FILTERS **c89**

C. B. Cosmovici, S. F. Green, D. W. Hughes, H. U. Keller, P. Mack, E. Moreno-Insertis, and H. U. Schmidt (Max-Planck-Inst. fuer Physik und Astrophysik, Garching, West Germany) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 375-379 Sponsored by CNR and the Science and Engineering Research Council Original contains color illustrations (For primary document see N87-25908 19-90)

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Between March 3 and 23, 1986 CCD systems of the same kind at 3 widely separated telescopes on La Palma were used to obtain 287 images with the Giotto Multicolor Camera (HMC) filters for studies of the inner coma of comet Halley near to the Giotto-encounter. The dominant dust emission in the coma as seen from HMC is directed 55 deg from the Sun to the south east, with a fanlike dust emission in the sunward direction with several substructures. In the groundbased images there are different jet structures pointing into the sunward half circle. One extends to 8000 km from the nucleus roughly in the same projected direction as the dominant emission in the HMC image. As it is more pronounced in the HMC image it may well be near to the line of sight of HMC and therefore enhanced by projection. It would then correspond to activity on the afternoon side of the nucleus. Continuum luminosity before encounter was decreasing but turned into a sharp rise after encounter. ESA

N87-25972# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Lab. de Physique Stellaire et Planetaire.

TEMPERATURE AND SIZE OF THE NUCLEUS OF HALLEY'S COMET DEDUCED FROM IKS INFRARED VEGA 1 MEASUREMENTS

C. Emerich, J. M. Lamarre, V. I. Moroz, M. Combes, N. F. Sanko, Yu. V. Nikolsky, F. Rocard, R. Gispert, N. Coron, J. P. Bibring (Paris-Sud Univ., Orsay, France) et al. *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 381-384 Sponsored by CNES (For primary document see N87-25908 19-90)

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The infrared thermal emission of the nucleus of Halley's comet was measured by the imaging channel of the IKS spectrometer in the wavelengths bands 7 to 10 microns and 9 to 14 microns and in 2 perpendicular directions of analysis. The effective dimensions of the infrared emissive region in these directions are estimated from a simulation of the flyby configuration, and compared to observations made in the visible range. A color temperature greater than 360 K is deduced using on-ground preflight calibrations. A temperature of the same order is also obtained independently, comparing the absolute value of the measured fluxes with model simulations. Such temperatures, significantly higher than the sublimating temperature of ices, are compared with surface temperatures predicted by the friable sponge model of cometary nucleus (Horanyi et al, 1984), suggesting the existence of a dust mantle layer covering parts of the nucleus surface, even at 0.8 AU. ESA

N87-25973# Academy of Sciences, Berlin (East Germany). Inst. fuer Kosmosforschung.

THERMAL STRESSES AND DUST DYNAMICS ON COMETS

E. Kuehrt, D. Moehlmann, B. Giese, and F. Tauber (Academy of Sciences, Potsdam, East Germany) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 385-388 (For primary document see N87-25908 19-90)

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Two processes that may have an important influence on the evolution of comets are discussed: thermal stresses and the gas-dust dynamics near the cometary surface. Thermal stresses due to the temperature differences between the surface and the core of the nucleus are calculated for different structure models. It is shown that for comets of P/Halley-type orbits, thermal stresses exceed the strength of water ice near to the surface resulting in cracks, splits, and outbursts. It is demonstrated that due to cometary gravitation and inhomogeneous outgassing, initially emitted dust can be redeposited at the cometary surface. The consequences of both processes for cometary activity are considered. ESA

N87-25974# Academy of Sciences (USSR), Dushanbe. Inst. of Astrophysics.

THERMAL REGIME AND SURFACE STRUCTURE OF PERIODIC COMET NUCLEI

O. V. Dobrovolsky, Kh. I. Ibadinov, S. Aliev, and S. I. Gerasimenko *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 389-393 (For primary document see N87-25908 19-90)

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On the basis of laboratory experiments with different cometary nuclei models and secular brightness decrease of natural comets the thermal regime and the surface structure of periodic comets were studied. The gradual formation of mineral crusts on nuclear surfaces of real comets is shown. ESA

N87-25975# Central Research Inst. for Physics, Budapest (Hungary).

AN ICY-GLUE NUCLEUS MODEL OF COMET HALLEY

Harry L. F. Houpis and Tamas I. Gombosi *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 397-401 (For primary document see N87-25908 19-90)

(Grant NSF AST-68-05994)

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Using Vega and Giotto data, a Halley nucleus model that retains the advantages of the icy conglomerate formalism on a local level, while at the same time introduces a global framework is outlined. A methodology for calculating the evolution and thermal profiles of the nucleus is presented. The fact that dust activity is confined for the most part to jets, that the majority of the surface is relatively inactive with a uniform porous dust covering, and that the altitude variations are of the order of 100 m, suggest that the nucleus is composed of large (tens of centimeters to hundreds of meters) porous refractory boulders, cemented together with an ice-dust grain mix of the icy conglomerate type (Whipple glue). The boulders are similar in composition to the outer asteroid belt objects and the irregular outer satellites of the giant planets, i.e., hydrous silicates containing complex carbon compounds. ESA

N87-25976# Oxford Univ. (England). Dept. of Astrophysics.

GIANT COMETS OR ORDINARY COMETS: PARENT BODIES OR PLANETESIMALS

S. V. M. Clube *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 403-408 (For primary document see N87-25908 19-90)

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The dynamical properties of the comet system are discussed. Two theoretical frameworks exist: (1) an Oort cloud with a heavy core separately replenishing the long and short period populations (the steady state model), or (2) a standard Oort cloud which is occasionally replenished from an external source and which is otherwise depleted as it intermittently supplies the short period population (the stochastically variable model). Two classes of theory exist in which the primary solid condensations in star-forming regions are either (a) unprocessed planetismals or (b) processed parent bodies. The combinations (1a) and (2b) are contrasted in the light of recent findings, especially the evidence for meteoroidal activity during the past 1500 yr. It seems that the stochastically variable model involving processed giant comets is in better accord with the facts. ESA

N87-25977# Toledo Univ., Ohio. Dept. of Physics and Astronomy.

GALACTIC TIDES AFFECT THE OORT CLOUD: AN OBSERVATIONAL CONFIRMATION

A. H. Delesemme and M. Patmiou *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 409-412 (For primary document see N87-25908 19-90)

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It is shown that the aphelia of the 152 known original orbits of the very long period comets (period greater than 10,000 yr) are not distributed at random on the celestial sphere, but manifest 3 zones of avoidance: one is a strip along the galactic equator and the others cover the galactic polar caps. Such a symmetry cannot be explained by the traditional mechanism bringing comets into visibility, because this mechanism is based on random stellar passages or on random passages of molecular clouds. Such a symmetry is predicted by the vertical galactic tide, namely the differential attraction, on the Sun and on the comets respectively, coming from the mass of the galactic disk. ESA

N87-25978# Consiglio Nazionale delle Ricerche, Rome (Italy). IAS-Planetologia.

SOME GENERAL FEATURES OF THE DYNAMICS OF HALLEY-TYPE COMETS

A. Carusi, L. Kresak (Slovak Academy of Sciences, Bratislava, Czechoslovakia), E. Perozzi, and G. B. Valsecchi *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 413-418 Sponsored by CNR and the Slovak Academy of Sciences (For primary document see N87-25908 19-90)

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Halley-type comets, i.e., those with revolution periods of 20 to 200 yr, are discussed. They can be dynamically defined by the values of their Tisserand invariants with respect to Jupiter, which account for the processes that brought these comets into the present orbits. Long-term integrations of their motion show oscillations of their heliocentric elements when the comets are far from the Sun and the center of their motion is the barycenter of the solar system. The shift from barycentric to heliocentric motion is also responsible for the major changes of orbital elements within a single revolution which, in the case of direct orbits, may follow regular libration patterns with periods of 350 to 400 yr. This is why periods concentrate around 70 yr. ESA

N87-25979*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PHYSICAL INTERPRETATIONS FROM THE MOTIONS OF COMETS HALLEY AND GIACOBINI-ZINNER
D. K. Yeomans *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 419-425 (For primary document see N87-25908 19-90)
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For comets Halley and Giacobini-Zinner (GZ), the model of the rocket-like, outgassing forces affecting the comet motion is shown to be consistent with the vaporization of water ice from the comet nuclei. For comet GZ, the dramatic time dependence of the outgassing forces suggests that this comet's spin axis passed through the orbit plane in the mid 1960's. Modeling of Halley's motion over two millennia indicates that the comet is rotating in a direct sense, with no obvious long-term time dependence in the average outgassing forces. The precession of the spin pole axis is not apparent. Secular changes in the comet's angular elements show no evidence for a ring of comet-like material beyond the orbit of Neptune. An obvious 1986 postperihelion bias in comet Halley's observation residuals is modeled by assuming a radial center-of-light/center-of-mass offset. ESA

N87-25980# Universisad de Los Andes, Merida (Venezuela). Dept. de Fisica.
SIZES, AGING RATES AND EXTINCTION DATES, OF COMETS HALLEY AND ENCKE
Ignacio Ferrin and Carlos Gil (Asociacion Carabobena de Astronomia, Valencia, Venezuela) *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 427-432 Sponsored by the Consejo Nacional de Investigaciones Cientificas y Technologicas, the Consejo de Desarrollo Cientifico, Humanistico y Technologico, and the Fundacion Polar (For primary document see N87-25908 19-90)
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The aging rates of comets Halley and Encke were derived using only naked eye observations to avoid instrumental effects. Both data sets were corrected for the twilight effect. The light curve for each comet permitted the evaluation of the absolute magnitude with no extrapolation. Both comets age significantly, and extinction dates 3800 + or - 1000 comet Halley and 2060 + or - 15 for Encke are calculated. The fraction of active surfaces area is 10% for Halley, and 0.02% for Encke. The diameter of comet Encke is 6.2 + or - 2.5 km. ESA

N87-25981# Slovak Academy of Sciences, Bratislava (Czechoslovakia). Inst. of Astronomy.
ON THE AGING PROCESS OF PERIODIC COMETS
L. Kresak *In* ESA Proceedings of the 20th ESLAB Symposium on the Exploration of Halley's Comet. Volume 2: Dust and Nucleus Dec. 1986 p 433-438 (For primary document see N87-25908 19-90)
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Implications of the observations of P/Halley for the problem of comet aging are discussed. It is suggested that the active lifetimes of short-period comets are punctuated by dormant phases. These are tentatively identified for several short-period comets by the absence of prediscovery observations on occasions when they should have been very bright and favorably placed. The concept of secular brightness decrease of comets appears untenable, since events occurring on shorter time scales are more outstanding than the general trend. A classification of the variety of such events is attempted. ESA

N87-25887*# Lamar Univ., Beaumont, Tex. Dept. of Geology.
RARE GAS ANALYSIS OF SIZE FRACTIONS FROM THE FAYETTEVILLE METEORITE
Jim L. Jordan *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 13 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 13 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N87-25892*# Clemson Univ., S.C. Dept. of Ceramic Engineering.
LUNAR COMPOSITE PRODUCTION Interim Report
William Lewis *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 14 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 14 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

N87-25982*# Stanford Univ., Calif. Dept. of Applied Physics.
RAPID TEMPORAL EVOLUTION OF RADIATION FROM NON-THERMAL ELECTRONS IN SOLAR FLARES
Edward T. Lu and Vahe Petrosian Jun. 1987 31 p
(Grants NsG-7092; NSF ATM-83-20439)
(NASA-CR-181055; NAS 1.26:181055; CSSA-ASTRO-87-5)
Avail: NTIS HC A03/MF A01 CSCL 03B

Solutions of the time dependent Fokker-Planck equation was found for accelerated electrons undergoing Coulomb collisions in a magnetized, fully ionized plasma. An exact solution was found for arbitrary pitch angle and energy distribution in a uniform background plasma. Then, for an inhomogeneous plasma, a solution was found for particles with small pitch angles. These solutions were used to calculate the temporal evolution of bremsstrahlung x-rays from short bursts of nonthermal electron beams, and these spectra were compared with observed high time resolution spectra of short timescale solar hard x-ray bursts. It is shown that the observed softening in time of the spectra rules out a homogeneous background and therefore the possibility of electrons being confined to the corona either because of converging magnetic field or high densities. The inhomogeneous solution was also applied to a model with constant coronal density and exponentially rising chromospheric density. The spectra are shown to be consistent with that produced by a collimated beam of electrons accelerated in the corona with certain given conditions.

These conditions could be violated if large pitch angle electrons are present. Author

N87-25983*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR HIGH-ENERGY ASTROPHYSICAL PLASMAS EXPLORER (SHAPE). VOLUME 1: PROPOSED CONCEPT, STATEMENT OF WORK AND COST PLAN
Brian R. Dennis, Franklin D. Martin, T. Prince, R. Lin, M. Bruner, L. Culhane, R. Ramaty, G. Doschek, G. Emslie, R. Lingenfelter (California Univ., La Jolla.) et al. Jul. 1986 98 p
(NASA-TM-89258; NAS 1.15:89258) Avail: NTIS HC A05/MF A01 CSCL 03B

The concept of the Solar High-Energy Astrophysical Plasmas Explorer (SHAPE) is studied. The primary goal is to understand the impulsive release of energy, efficient acceleration of particles to high energies, and rapid transport of energy. Solar flare studies are the centerpieces of the investigation because in flares these high energy processes can be studied in unmatched detail at most wavelenth regions of the electromagnetic spectrum as well as in energetic charged particles and neutrons. Author

N87-25885*# Houston Univ., Tex. Dept. of Mathematics.
SOLAR PREDICTION AND INTELLIGENT MACHINES
Gordon G. Johnson *In* NASA. Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1986, Volume 2 Jun. 1987 6 p (For primary document see Summer Faculty Fellowship Program, 1986, Volume 2 6 p (SEE N87-25884 19-85)
Avail: NTIS HC A13/MF A01 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N87-25984*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC RAY HEAVY ION LET MAPPING FOR ALUMINUM, SILICON, AND TISSUE TARGETS
E. G. Stassinopoulos, J. M. Barth, and T. M. Jordan (EMP Consultants, Northridge, Calif.) Apr. 1987 264 p
(NASA-RP-1180; Rept-87B0034; NAS 1.61:1180) Avail: NTIS HC A12/MF A01 CSCL 03B

Linear energy transfer (LET) values in aluminum, silicon, and tissue targets have been calculated for 31 galactic cosmic ray ion species in eight different units. The values are described for single event upset (SEU) effect assessments or radiobiological evaluations. The data are presented in graphical and tabular form. Author

N87-25985# Kiel Univ. (West Germany). Mathematische-Naturwissenschaftlichen Fakultaet.
MEASUREMENT OF THE MASS OF THE MAIN IRON ISOTOPE IN THE COSMIC RADIATION Ph.D. Thesis [MESSUNG DER MASSE DES HAUPTEISENISOTOPES IN DER KOSMISCHEN STRAHLUNG]
Gerald Sermund Dec. 1986 127 p In GERMAN
(ETN-87-99350) Avail: NTIS HC A07

The mass of the main isotopes of iron in cosmic radiation was measured using active electronic detectors and passive range detectors. This combination of electronic detectors (Cerenkov and scintillation counters) and range detectors (a stack of sheets of several elastic materials), allows to separate events occurring with a time difference of 0.45 sec. In the electronic part the particle charge was determined by an energy/energy loss measurement; in the range detector it was determined from the trace the particle causes in the material (resolution of 0.2 charge units). The charge measurement was calibrated using the iron nuclei of the cosmic radiation. The combination of Cerenkov signals and range values allows the mass determination (resolution between 0.4 and 0.7 atomic mass units). The average value for iron isotope masses in cosmic radiation is 55.8. This mass measurement has the advantage that it does not require a calibration by heavy ion irradiation which leads to errors. Errors due to changing conditions are also avoided by keeping pressure and temperature constant. ESA

99 GENERAL

N87-25986# Vibration Inst., Clarendon Hills, Ill.
THE SHOCK AND VIBRATION DIGEST, VOLUME 19, NO. 7 Monthly Report
Judith Nagle-Eshlemann, ed. Jul. 1987 76 p
Avail: NTIS HC A05/MF A01

This digest provides efficient transfer of sound, shock and vibration technology among researchers and practicing engineers. Subjective and objective analyses of the literature are provided along with news and editorial material. Featured articles this month are: On integrating a logarithmic or semilogarithmic piecewise linear PSD plot of a random variable X(T): Part 2; and a Literature Review - Dynamic mechanical properties of advanced composite materials and structures. For individual titles, see N87-25987 through N87-25988.

N87-25987# Wyle Labs., Inc., Huntsville, Ala.
ON INTEGRATING A LOGARITHMIC OR SEMILOGARITHMIC PIECEWISE LINEAR PSD PLOT OF A RANDOM VARIABLE X(T), PART 2 **c64**
R. E. Doyle *In* Vibration Inst., The Shock and Vibration Digest, Volume 19, No. 7 Jul. 1987 p 3-12 (For primary document see N87-25986 19-99)
Avail: NTIS HC A05/MF A01

In this three part article, formulas for integrating a piecewise linear power spectral density (PSD) plot, to obtain the composite root mean square (rms) value, are derived and tabulated for three analytically distinct cases. Part 1 treats Case 1: a logarithmic plot with the W and f scales both logarithmic. Part 2 treats Case 2 and Case 3: Case 2 is a semilogarithmic plot with the W scale logarithmic and the f scale uniform; Case 3 is a semilogarithmic plot with the W scale uniform and the f scale logarithmic. Part 3 presents numerical examples illustrating the three cases. A comparative study of the results obtained provides insight into PSD plots in general. Integration errors and the effect of different scales on the composite rms value are examined. The treatment is general, expository and applicable to the design and analysis of structures and equipment subjected to random vibration environments. Author

N87-25988# Idaho Univ., Moscow. Dept. of Mechanical Engineering.
DYNAMIC MECHANICAL PROPERTIES OF ADVANCED COMPOSITE MATERIALS AND STRUCTURES: A REVIEW **c24**
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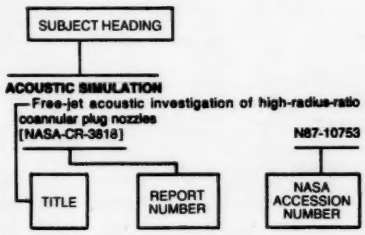
Progress is reviewed in the analytical and experimental characterization of dynamic properties of advanced composite materials and structures during the period 1983 to 1986. The implications of this research and the directions of continued research are discussed. Author

Typical Subject Index Listing



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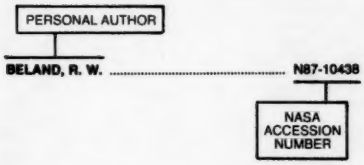

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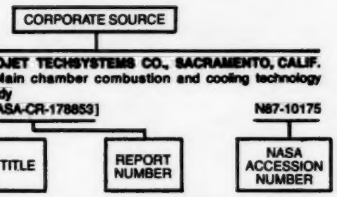

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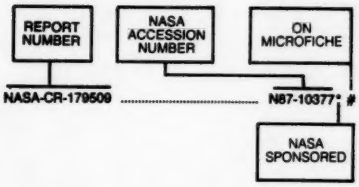

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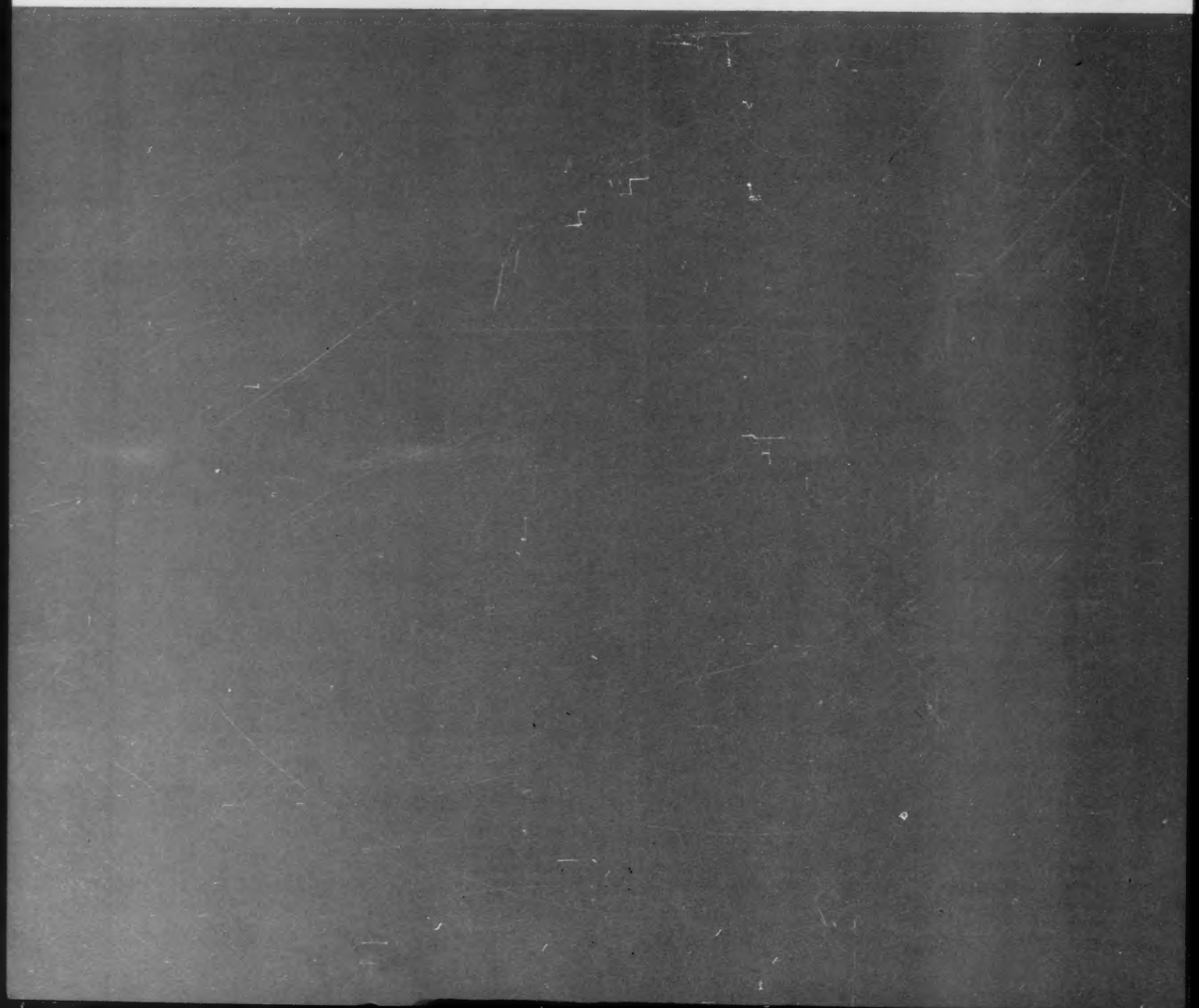
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